SUPPORTING DESIGN REPORT FOR WETLAND ENHANCEMENTS TO IMPROVE THE WATER QUALITY OF CEDAR LAKE

June 2002

Prepared for:

Cedar Lake Enhancement Association, Inc.
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CEDAR LAKE ENHANCEMENT PROJECT
SUPPORTING DESIGN REPORT

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SUPPORTING DESIGN REPORT FOR WETLAND ENHANCEMENTS TO IMPROVE THE WATER QUALITY OF CEDAR LAKE

INTRODUCTION

This Supporting Design Report summarizes the procedures, criteria, and results of analyses used for the design of a wetland developed to enhance the water quality of Cedar Lake. The structure is designed to trap sediment and sediment-borne nutrients that discharge from Sleepy Hollow Ditch into Cedar Lake.

Cedar Lake is a public recreation and scenic resource. Principal activities are boating, fishing, and lakeshore recreation. The wetland enhancement area for Sleepy Hollow Ditch is shown in Figure 1. The enhancement efforts described in this report are being performed by the Cedar Lake Enhancement Association, Inc. (CLEA) with partial funding from the Indiana Department of Natural Resource's T-by-2000 Program and the Indiana Department of Environmental Management 319 Program. Site easements have been obtained through donations by affected landowners.

LOCATION

Cedar Lake is a 781-acre natural lake located in Lake County in northern Indiana. The enhanced wetland area lies to the west of Cedar Lake in the southwest ¼ of Section 34, Township 34 N, Range 9 E (Figure 1). The existing watershed land use upstream of the wetland development site is predominantly agricultural. Underbrush and saplings line the stream bank in this area with areas outside of the immediate floodplain being used for agricultural purposes. The normal pool ponded area will be limited to the immediate stream channel. During short-term detention, ponding will cover approximately one acre.

OBJECTIVE OF PROJECT DESIGN

Background

A 1999 feasibility study of measures to remedy water quality impairments to Cedar Lake recommended construction of a wetland along Sleepy Hollow Ditch. The CLEA negotiated with the landowner for many months to secure an easement for the wetland enhancement area. The purpose for locating the structure at its present location is to development a wetland fed by Sleepy Hollow Ditch to capture sediment and nutrients (particularly sediment-bound phosphorus) now flowing into Cedar Lake and contributing to water quality impairments.

Design Objectives

The design objectives are to further enhance Cedar Lake water quality by improving the efficiency of sediment being trapped in the Sleepy Hollow Ditch watershed.

The overall lifespan of the lake will be prolonged by slowing the accumulation of sediment in the lake bottom. Additionally, internal recycling of nutrients from the lake sediments has been problematic. The enhancement measure will remove nutrients sorbed to the sediment.

Construction Requirements

The Cedar Lake Enhancement Association, Inc. retained MWH Americas, Inc. in 1999 to design the wetland enhancement along Sleepy Hollow Ditch. Enhancement will be conducted in the following manner.

The first task includes mobilization and demobilization of construction equipment, materials, and manpower to do the work. Demobilization will not be complete until clean-up of the site is considered complete by the inspector.

The second task will be the construction of the new plastic sheetpile weir. The location and section of the weir is shown on Figures 1 and 2.

The third task is the restoration of the streambank to preconstruction conditions in the vicinity of the weir. Parts of the streambank disturbed by construction equipment will be regraded and reseeded or otherwise restored to a neat appearance.

Design details of the Sleepy Hollow Ditch Wetland Enhancement Project are presented in Figures 1 and 2.

DESCRIPTION OF THE PROJECT

The project consists of a low head weir that will protect Cedar Lake water quality by retaining sediment and sediment-bound nutrients transported by small and moderate-sized storms. Nutrients retained by the structure will primarily occur during deposition of water transported sediments. Storms producing significant amounts of runoff will pass over the weir while generating a negligible backwater effect.

The weir crest will project a maximum of 4 feet above the existing ground elevation and will extend approximately 48 feet between the floodplain boundaries. Removal of vegetation along the footprint of the structure will be required for construction. Otherwise, disturbance of the wetland and channel during construction will be minimal.

The terrain on either side of the weir is sufficiently broad and stable to allow a backhoe to be driven up to the weir so that the structure can be maintained and accumulated sediment removed from behind the weir and the abutments.

Operation during low and normal flows

The weir is designed with a notch located along the axis of Sleepy Hollow Ditch. During periods of low flow, the notched-weir creates a permanent wetland behind the structure.

During runoff events, a temporary detention pool is formed behind the wetland up to the elevation where water spills over the length of the weir crest. The temporary pool is designed to drain from its maximum elevation to the level of the permanent pool (level of the weir notch) to allow a period of time for sediment and sediment-bound nutrients to settle in the wetland.

By allowing wetland water levels to fluctuate below the permanent pool level and the maximum flood pool, the notch aids in maintaining the hydrologic balance of the wetland. Because low flows typically carry little sediment or sediment-bound nutrients or chemicals, passage of low flows over the notch at the permanent pool level does not compromise the weir's water quality enhancement function.

Operation during moderate runoff events

The primary purpose of the proposed weir is to provide a period of extended detention during moderate runoff events and during the first flush of larger events. By reducing the flow velocity in Sleepy Hollow Ditch and briefly detaining runoff in the wetland, sedimentation of soil particles is promoted. Nutrients absorbed by these particles will then be retained in the wetland rather than be deposited in Cedar Lake.

Operation during major runoff events

During high flows, the weir is designed to be completely submerged and to offer little obstruction to flood flows. Because of its low height, the weir will have negligible effect on upstream water levels and on inundation caused by flood flows. Flow of bed load sediment during floods will be impeded by the submerged weir.

Figure 3 illustrates the influence of the project on wetland hydroperiods. The wetland structure will create an area that is saturated (F) and permanently flooded (E). The structure will retard storm runoff increasing the duration of intermittent flooding (D). Drainage over the weir crest and through the notch will permit sufficiently rapid drainage to cause little expansion of the area that is semipermanently flooded (C), no expansion of the area that is seasonally flooded (B), and minor expansion of the area that is temporarily flooded (A).

- *Temporarily Flooded.* Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface.

- *Seasonally Flooded.* Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

- *Semipermanently Flooded.* Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

- *Intermittently Exposed.* Surface water is present throughout the year except in years of extreme drought.

- *Saturated.* The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

HYDROLOGY AND HYDRAULICS

Hydrology and hydraulic computations were conducted to determine the stormwater inflow rate and the sediment trap size requirements. Results and additional information are presented in Appendix A.

Procedures

The Sleepy Hollow Ditch wetland enhancement site has a watershed area of 619 acres and an estimated critical storm flow of 323 cfs. The critical storm is the 100 year 3 hour event as determined using TR-20. Flood discharge volume was estimated to evaluate qualitative effects of peak runoff attenuation.

Hydraulic Design Criteria

- The structure must retain the gravel, sand, and silt sized particles.
- The structure must not cause significant backwater effect on upstream areas.
- The structure must be designed for the critical storm.

Resulting Design

Using a one-foot contour survey data, a HEC-RAS model was built to model flows through the stream. The 100 year 3 hours storm was routed through the stream using the model along with a number of other storm events (Appendix A). The weir was configured in the model as shown in Figure 2. The weir was designed in order to enhance trap efficiency of the structure, but to also avoid damaging vegetation that is established in the floodplain. The Indiana Department of Environmental Management requested that clearing of trees and permanent ponding that would kill trees be removed from the design. Because of this, we have added the notch to the weir, which will maintain a permanent pool that is confined to the existing streambed corridor. During high flow events, the weir will cause the water to backup into the floodplain from where it will gradually be released to the notch elevation. A summary of ponded area in the wetland enhancement area is tabulated below based on elevation.

Elevation	Area Ponded (acres)	Storage Volume (acre-feet)
709	0.04	0.01
710 – Weir notch elevation	0.13	0.06
711	0.33	0.26
712	0.62	0.51
713 – Elevation of top of weir	1.08	1.03

SEDIMENT TRAPPING EFFICIENCY

A spreadsheet model was used to determine sediment trapping efficiency. This model used estimates of particle settling velocity and weir overflow velocity to estimate the amount of sediment retained in the structure. Results of the trapping efficiency of the wetland are presented in Appendix B. A summary of these results is tabulated below.

Design Storm	Sediment Load (metric tons)	Velocity (ft/s)	Removal Efficiency (%)
1-yr, 3-hr	31	0.73	47
2-yr, 3-hr	42	0.8	47
5-yr, 3-hr	61	1.04	45
10-yr, 3-hr	80	1.25	44
25-yr, 3-hr	116	1.56	43
50-yr, 3-hr	152	1.79	42
100-yr, 3-hr	196	2.19	41

As is shown, removal efficiencies range from 41 to 47%, with the highest removal efficiencies noted for the more frequent rain events (one and two year storms).

ENVIRONMENTAL ISSUES

The primary environmental consequence of the project will be to reduce sediment and associated chemical transport to Cedar Lake. As noted in the IDNR's letter and the U.S. Department of Interior Fish and Wildlife Service's letter contained in Appendix C, no vulnerable plant or animal species of either state or federal significance have been reported to occur in the project vicinity.

MAPPING AND SURVEYING

Mapping and surveying of the Sleepy Hollow Ditch wetland was conducted by Air Maps, Inc. during November 1993. Mapping of the wetland enhancement area is shown in Figure 1.

GEOTECHNICAL INVESTIGATIONS

To define the foundation characteristics of the proposed low weir structure and to establish design criteria, MWH conducted a subsurface and laboratory testing program (Appendix D). The subsurface exploration program included one boring in the vicinity of the proposed weir location (Figure 1).

Subsurface soil exploration and laboratory testing of soil samples were conducted in accordance with standard practices. The results of the soil exploration and testing were

used to determine criteria for construction of the wetland control structure. Drilling was performed in June 2002.

Sampling was conducted and samples were visually classified in the field. Soil samples were retained for test in the subcontractor's soil laboratory. Laboratory testing included Atterberg Limits, gradation analysis, moisture content, visual classification, and triaxial compression, of selected samples.

WETLAND VEGETATION PLANTING

Wetland vegetation can enhance the sediment trap process by increasing trapping efficiency by flowing water velocities and by absorbing and assimilating pollutants. Given that the enhancement will be established in late summer, it is not recommended that wetland vegetation be planted or transplanted within the enhancement area at the time of construction. This upstream area becomes dry a majority of the late summer and fall and hence vegetation will not likely establish. It is recommended that plantings, if required, be delayed by a year to see what establishes naturally in the enhancement area. There is currently a dense mix of vegetation in the floodplain of the enhancement area. It is likely that additional planting will not be required.

PERMITTING STATUS

Permits necessary for construction of the enhanced wetland have been approved. Copies of the following documents are contained in Appendix E:

- Army Corps of Engineers Section 404 Permit;
- IDEM 401 Water Quality Permit;
- Letter from IDNR indicating a permit is not required; and
- County Surveyor letter indicating that Sleepy Hollow Ditch is not a regulated drain.

STABILITY ANALYSIS

The C-LOC® Sheet Pile Design Program Version 1.1 was used to determine the stability of the plastic sheetpile weir. Appendix F presents the input and output of the model. The design included appropriate walings and anchors to provide stability to the weir. Stability was analyzed for a flow velocity of 4.5 ft/s, which is the HEC-RAS estimated velocity of a 100-year flood. The pressure on the crest of the weir at this flow velocity is approximately 125 pounds per square foot. The pressure at the base of the weir (streambed elevation) at this flow velocity is approximately 390 pounds per square foot. The model was calibrated to approximate these conditions. As shown in Appendix F, with the appropriate waling and anchoring, the designed weir is stable.

INSPECTION PLAN

Removal and off-site disposal of soft sediments

Measurement of the quantity of soft sediment removed from the site will be based on survey data. The inspector shall verify that the surveying procedure is accurate for computation of the quantity.

The inspector will verify that roadways are cleaned and maintained during construction as directed by the specifications.

Placement of sheetpile

Measurement of the quantity and type of sheetpile used will be verified by the inspector. The inspector will also verify by survey the level of the weir crest and the dimensions of the weir notch.

Restoration of shoreline to preconstruction condition

After construction completion, the inspector will verify that the shoreline and construction staging area have been restored to preconstruction condition. The inspector will be required to signify that the work is complete before the contractor will receive payment for this item.

OPERATION AND MAINTENANCE / MONITORING PLAN

The low head weir spanning Sleepy Hollow Ditch is designed to trap sediment immediately behind it. The time required to fill the wetland with deposited sediment is unknown but estimated to be three to five years, for the area immediately behind the weir. Therefore, the determination of the long-term maintenance cycle will be based on information gathered during the first five years of site monitoring.

During the first two years, the deposition of silt in the wetland, the condition of the weir and its abutments, and changes in the extent or type of wetland vegetation should be inspected every six months. Sediment should be removed from behind the weir when it is more than 60 percent full. All recovered sediment should be placed in upland disposal areas outside of the delineated wetland.

After two years, if maintenance requirements prove to be minimal, then the frequency of inspection can be reduced to once every year. If maintenance requirements continue to be minimal after four years, then the maintenance schedule can be further reduced to once every two years.

Inspection and maintenance report forms are included in Appendix F.

CONSTRUCTION COST ESTIMATE

Project construction costs are estimated to be $45,000, including construction inspection, administration, and engineering. The cost estimate details are shown in Appendix H.

FIGURES

CEDAR LAKE ENHANCEMENT ASSOCIATION, INC.

CEDAR LAKE, INDIANA

SLEEPY HOLLOW DITCH WETLAND ENHANCEMENT PROJECT

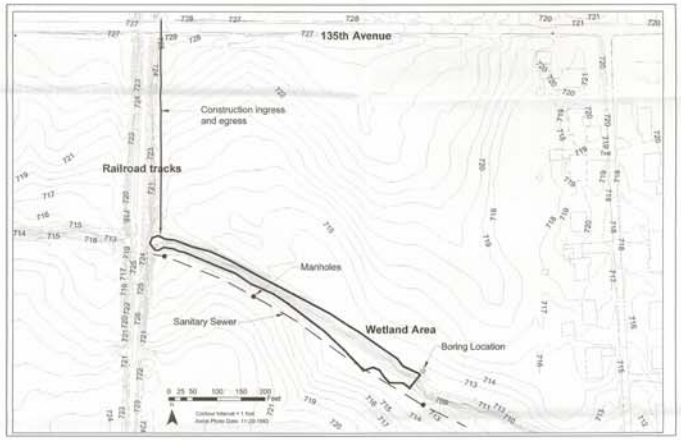
June 2002

NOTES:

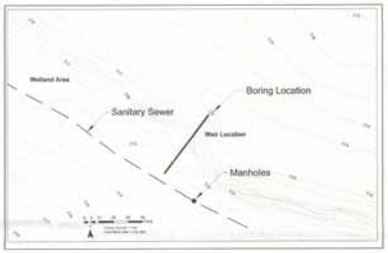
1. THE PLASTIC SHEET PILE SHALL BE CL-9900 MANUFACTURED BY CRANE PRODUCTS, LTD. OR EQUAL. SEE TYPICAL SECTION ON SHEET 2.
2. THE ALIGNMENT OF THE CONTROL STRUCTURE IS APPROXIMATELY PERPENDICULAR TO THE CENTER LINE OF SLEEPY HOLLOW DITCH. THE FINAL ALIGNMENT SHALL BE ADJUSTED TO AN ALIGNMENT THAT WILL PROVIDE THE MOST SUITABLE FOUNDATION FOR THE STRUCTURE AND ACCEPTABLE FLOW CONDITION. FINAL ALIGNMENT IS SUBJECT TO THE APPROVAL OF THE CEDAR LAKE ENHANCEMENT ASSOCIATION.
3. THE MINIMUM EMBEDMENT LENGTH SHALL BE 8 FEET FROM THE TOP OF DENSE SOIL OR GRAVEL. THE DESIGN ASSUMES EL. 709.
4. THE FINAL ALIGNMENT OF THE STRUCTURE SHALL BE ADJUSTED TO MINIMIZE INTERFERENCE FROM BURIED DEBRIS WHICH MAY IMPEDE DRIVING OF SHEETPILE.
5. THE AERIAL SURVEY PHOTO CONTROL WAS PROVIDED BY BENCH MARK CL 7. THIS IS A RAILROAD SPIKE IN THE WEST SIDE OF POWER POLE #803/303 LOCATED AT THE SOUTHWEST CORNER OF 135TH PLACE AND PARRISH AVENUE.
6. THE APPROXIMATE LOCATION OF A SEWER LINE IS SHOWN ON THIS SHEET. CONTRACTOR SHALL VERIFY THE EXACT LOCATION OF THIS LINE AND AVOID DISTRUBING IT.

DRAWING INDEX	
SHEET No.	DRAWING TITLE
4050004-01	COVER / GENERAL NOTES
4050004-02	SEDIMENT TRAP PLAN AND SECTION

AREA MAP



WETLAND ENHANCEMENT AREA MAP



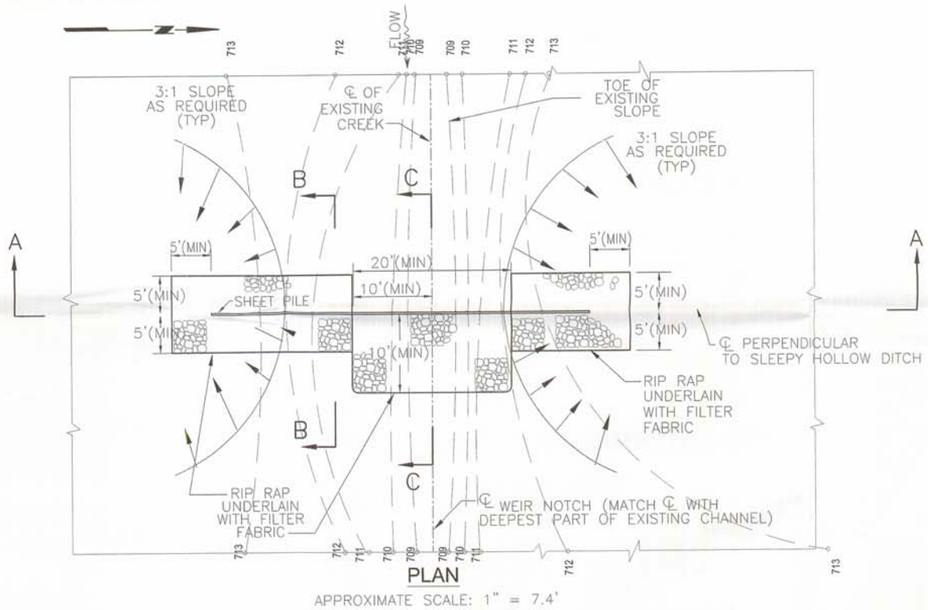
WEIR LOCATION MAP

MWH Americas, Inc.

ENVIRONMENTAL MANAGEMENT SECTION

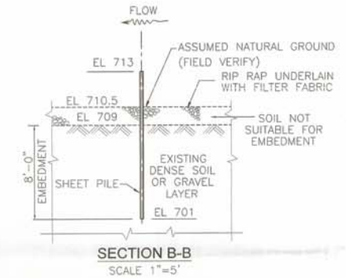
SEARS TOWER • 233 South Wacker Drive • Chicago, Illinois 60606-6392 • Tel: (312) 831-3800 • Fax: (312) 831-3976

SHEET NO	TOTAL SHEETS



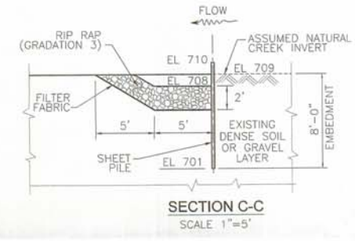
PLAN

APPROXIMATE SCALE: 1" = 7.4'



SECTION B-B

SCALE 1"=5'

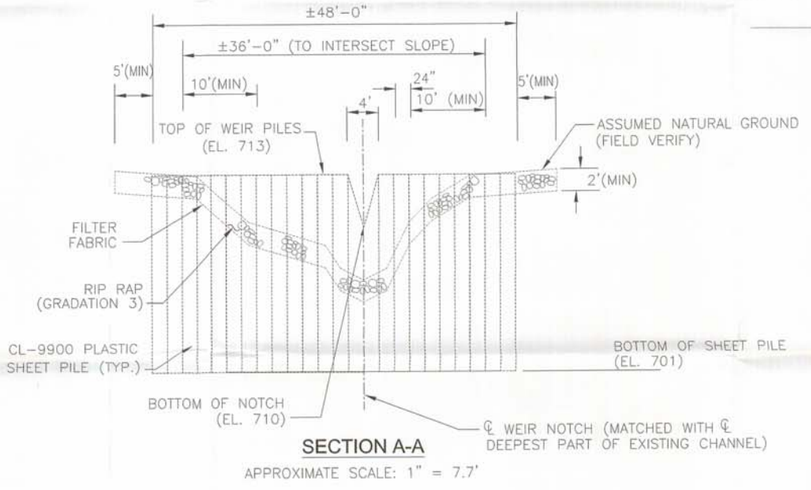


SECTION C-C

SCALE 1"=5'

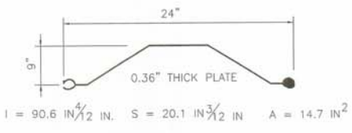
NOTES:

1. SHEETPILE REQUIRES PLASTIC CAP ON TOP OF PILINGS APPROPRIATE FOR THIS DESIGN.
2. SHEETPILE WEIR REQUIRES APPROPRIATE ANCHORING AND WAILING. DESIGN ASSUMES 4"X6" TIMBER WAILINGS THAT CAN WITHSTAND A MAXIMUM BENDING STRESS OF AT LEAST 1500 PSI DESIGN ASSUMES ANCHORS LOCATED ONE FOOT BELOW SHEETPILE AND EVERY FIVE FEET. ANCHORS SHOULD HAVE A CAPACITY OF AT LEAST 8,000 LBS.



SECTION A-A

APPROXIMATE SCALE: 1" = 7.7'



TYP. SECTION OF CL-9900 PLASTIC SHEET PILE

NOT TO SCALE

APPROVED				ENGINEER'S SEAL
DSGN.		REVIEWED		DOUGLAS L. MULVEY REGISTERED NO. 10100293 STATE OF INDIANA PROFESSIONAL ENGINEER
CHKD.		CIVIL.		
DWN.		MECH.		
CHKD.		ELECT.		
SUBM.				

REV. NO.	DWG. TRANSMITTAL LETTER NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.

CEDAR LAKE ENHANCEMENT ASSOCIATION, INC.
CEDAR LAKE, INDIANA

SLEEPY HOLLOW DITCH WETLAND ENHANCEMENT PROJECT

SEDIMENT TRAP PLAN AND SECTION

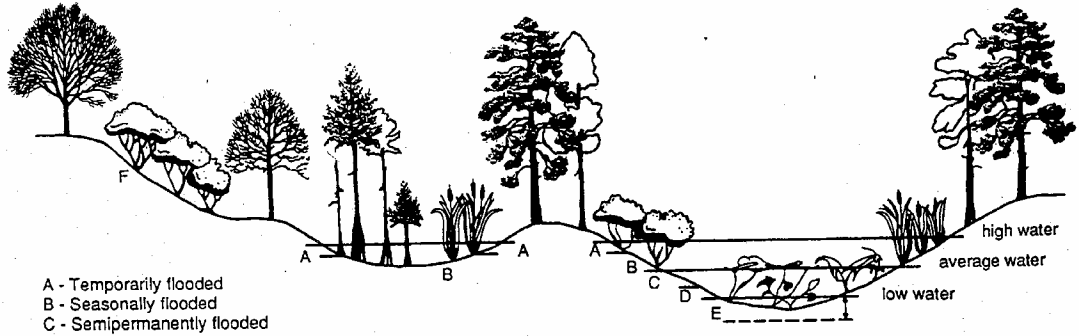
MWH AMERICAS, INC.
CHICAGO, ILLINOIS

DOUG MULVEY
PROJECT MANAGER

DATE: JUNE 2002

DRAWING No. 4050004-02

z:/hamilton_lake/fig3.cdr



A - Temporarily flooded
B - Seasonally flooded
C - Semipermanently flooded
D - Intermittently exposed
E - Permanently flooded
F - Saturated

(Source: Cowardin et al., 1979)

Figure 3
WETLAND HYDROPERIOD
SUPPORTING DESIGN REPORT

APPENDICES

APPENDIX A

Information used in Hydraulic and Hydrologic Modeling

A preliminary hydraulic and hydrologic analysis was performed to determine the potential for sediment control within portions of the Sleepy Hollow Ditch watershed and compliance with the Indiana dam safety regulations and flood control. The headwaters of Sleepy Hollow Ditch Creek are located in Lake County, and the stream flows from the northwest to the southeast. The 619-acre drainage area upstream of the sedimentation basin weir is largely agricultural. Land uses calculated from the Indiana GAP database are tabluted below.

LAND USE IN CEDAR LAKE WATERSHED
(Source: Indiana GAP Database)

Land Use	Acres
Urban	106
Agriculture	270
Pasture	230
Forest/Woodland	13

Rainfall events are characterized by their recurrence interval, their intensity, and duration. Recurrence intervals are considered over a long period of record, and reflect the average period of time expected between occurrences of that particular storm event. For example, a rainfall event with a 10-year recurrence interval has a 10% probability of being equaled or exceeded in any given year.

Peak storm flows were calculated from the above land uses and rainfall frequencies published by Huff and Angel (1992), using the Soil Conservation Service's TR-20 model (SCS, 1992) for watershed runoff. A sensitivity analysis on the TR-20 was performed and the critical storm was found to be 3 hours in duration (see included hydrographs). The peak flow values for 3-hour storms at various recurrence intervals are tabulated below.

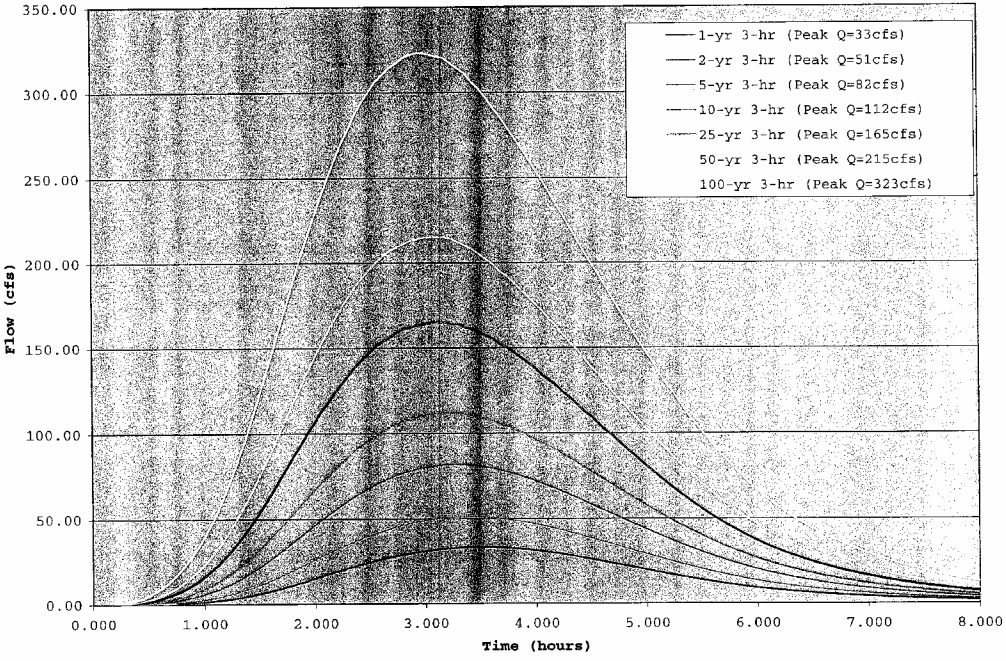
PEAK STORM FLOWS AT SLEEPY HOLLOW DITCH WEIR

Recurrence Interval (3-hour)	Peak Flow (cfs)
1-Year	33
2-Year	51
5-Year	82
10-Year	112
25-Year	165
50-Year	215
100-Year	323

The HEC-RAS (Hydrologic Engineering Center's River Analysis System developed by the U.S. Army Corps of Engineers) program was used to perform a one-dimensional steady flow analysis of the stream conditions for the sediment trap on site. Channel geometry at the weir was developed from a 1-foot contours interval survey performed in 1993. The geometry of the existing culvert under the railroad was measured during a site visit. Peak storm flows were obtained from the table above, and the model was run for each storm event.

The weir structure modeled was 48 feet long with a top elevation of 713 MSL, with a V-notch four feet wide and three feet deep. Results with and without the weir structure are provided herein along with comparison tables.

CEDAR LAKE
RUNOFF HYDROGRAPHS



Current Conditions of Sleepy Hollow Ditch
No Weir — Model Output

HEC-RAS Plan: Cedar River: Cedar Lake River Reach: 1

River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
	33.00	713.94	715.30		715.33	0.001755	1.37	24.06	35.44	0.29
	51.00	713.94	715.54		715.58	0.001795	1.52	33.57	43.13	0.30
	82.00	713.94	715.90		715.94	0.001604	1.59	51.58	56.92	0.29
	112.00	713.94	716.29		716.32	0.001073	1.46	76.59	70.88	0.25
	165.00	713.94	716.86		716.89	0.000659	1.36	121.52	87.19	0.20
	215.00	713.94	717.45		717.47	0.000420	1.20	178.79	109.86	0.17
	323.00	713.94	718.66		718.67	0.000145	0.99	346.53	167.97	0.11
	33.00	713.53	714.78		714.83	0.003400	1.80	18.34	29.48	0.40
	51.00	713.53	715.08		715.13	0.002492	1.80	28.27	35.85	0.36
	82.00	713.53	715.57		715.62	0.001481	1.71	48.02	44.74	0.29
	112.00	713.53	716.06		716.08	0.001211	1.26	89.16	113.49	0.25
	165.00	713.53	716.77		716.78	0.000351	0.89	185.27	156.13	0.14
	215.00	713.53	717.41		717.41	0.000172	0.72	300.46	206.26	0.10
	323.00	713.53	718.65		718.65	0.000051	0.51	639.07	323.17	0.06
	33.00	713.30	714.22	714.19	714.55	0.017851	4.56	7.23	23.21	0.95
	51.00	713.30	714.50	714.43	714.91	0.014338	5.08	10.03	30.23	0.89
	82.00	713.30	714.96	714.77	715.45	0.010699	5.63	14.56	41.82	0.82
	112.00	713.30	715.37	715.07	715.93	0.008674	5.99	18.70	72.10	0.77
	165.00	713.30	716.01	715.53	716.68	0.007080	6.58	25.08	118.95	0.73
	215.00	713.30	716.54	715.92	717.32	0.006348	7.08	30.37	148.11	0.72
	323.00	713.30	717.57	716.68	718.55	0.005400	7.94	40.70	233.94	0.69
	Culvert									
	33.00	713.07	714.21	713.94	714.39	0.006870	3.43	9.63	32.12	0.62
	51.00	713.07	714.36	714.18	714.69	0.010111	4.58	11.14	39.09	0.76
	82.00	713.07	714.53	714.53	715.16	0.016157	6.37	12.87	46.25	0.99
	112.00	713.07	714.82	714.82	715.61	0.015502	7.13	15.71	58.18	1.00
	165.00	713.07	715.29	715.29	716.30	0.014121	8.10	20.38	87.72	1.00
	215.00	713.07	715.67	715.67	716.89	0.013491	8.88	24.22	108.50	1.01
	323.00	713.07	716.44	716.44	718.03	0.012134	10.12	31.92	149.14	1.00
	33.00	712.83	714.30		714.31	0.000632	0.88	37.69	50.63	0.18
	51.00	712.83	714.54		714.56	0.000663	1.00	51.09	58.42	0.19
	82.00	712.83	714.84		714.86	0.000786	1.17	70.38	72.53	0.21
	112.00	712.83	715.06		715.08	0.000896	1.28	87.45	86.30	0.22
	165.00	712.83	715.37		715.40	0.000917	1.42	116.57	100.79	0.23
	215.00	712.83	715.70		715.73	0.000764	1.41	152.69	115.96	0.22
	323.00	712.83	716.04		716.09	0.000896	1.65	195.21	131.19	0.24
	33.00	713.09	714.07		714.17	0.009460	2.56	12.89	26.31	0.64
	51.00	713.09	714.34		714.43	0.006178	2.45	20.83	33.06	0.54
	82.00	713.09	714.60		714.72	0.005548	2.69	30.54	38.90	0.53
	112.00	713.09	714.78		714.92	0.005765	2.96	37.80	42.76	0.56
	165.00	713.09	715.07		715.23	0.005527	3.23	51.01	49.00	0.56
	215.00	713.09	715.46		715.60	0.003739	2.98	72.03	58.22	0.47
	323.00	713.09	715.71		715.92	0.005084	3.71	87.18	64.15	0.56
	33.00	712.23	714.00		714.02	0.000582	0.99	33.39	35.03	0.18
	51.00	712.23	714.25		714.27	0.000700	1.20	42.51	38.26	0.20
	82.00	712.23	714.48		714.52	0.001040	1.58	51.74	41.27	0.25
	112.00	712.23	714.62		714.67	0.001453	1.95	57.37	43.01	0.30
	165.00	712.23	714.86		714.95	0.001956	2.42	68.11	46.13	0.35
	215.00	712.23	715.13		715.21	0.005117	2.36	91.12	132.69	0.50
	323.00	712.23	715.32		715.43	0.005667	2.73	118.16	149.00	0.54
	33.00	712.45	713.94		713.96	0.001362	1.28	25.70	34.50	0.26
	51.00	712.45	714.17		714.21	0.001831	1.43	35.65	50.86	0.30
	82.00	712.45	714.38		714.42	0.002607	1.72	47.71	67.41	0.36
	112.00	712.45	714.48		714.54	0.003581	2.05	54.67	75.32	0.42
	165.00	712.45	714.67		714.74	0.006620	2.20	74.88	146.79	0.54
	215.00	712.45	714.75		714.85	0.007126	2.44	88.12	156.67	0.57
	323.00	712.45	714.93		715.05	0.007033	2.77	116.68	170.00	0.59
	33.00	712.75	713.60	713.58	713.80	0.022415	3.57	9.24	21.86	0.97
	51.00	712.75	713.75	713.75	713.99	0.022146	3.96	12.87	25.79	0.99
	82.00	712.75	714.11		714.19	0.017728	2.24	36.56	146.15	0.79
	112.00	712.75	714.19		714.27	0.013009	2.28	49.09	151.63	0.71
	165.00	712.75	714.34		714.42	0.008252	2.28	72.25	158.40	0.60
	215.00	712.75	714.47		714.56	0.006271	2.30	93.31	164.33	0.54
	323.00	712.75	714.68		714.78	0.005298	2.52	128.02	173.34	0.52

HEC-RAS Plan: Cedar_River_Cedar Lake River_Reach: 1 (Continued)

33.00	711.66	712.61	712.61	712.85	0.023851	3.95	8.35	17.72	1.01
51.00	711.66	712.79	712.79	713.07	0.022522	4.31	11.82	21.08	1.02
82.00	711.66	713.02	713.02	713.37	0.021063	4.74	17.31	25.51	1.01
112.00	711.66	713.21	713.21	713.60	0.019469	4.97	22.53	29.10	1.00
165.00	711.66	713.48	713.48	713.91	0.019539	5.25	31.38	37.42	1.01
215.00	711.66	713.76		714.15	0.015103	4.95	43.37	46.50	0.91
323.00	711.66	714.32		714.48	0.009915	3.20	100.84	152.61	0.69
33.00	710.59	712.40		712.42	0.000700	1.05	31.44	34.50	0.19
51.00	710.59	712.64		712.66	0.000914	1.26	40.41	41.22	0.22
82.00	710.59	712.94		712.98	0.001145	1.51	54.25	50.03	0.26
112.00	710.59	713.18		713.22	0.001292	1.68	66.77	57.70	0.27
165.00	710.59	713.52		713.57	0.001529	1.86	88.73	74.57	0.30
215.00	710.59	713.76		713.82	0.001723	1.96	109.56	92.96	0.32
323.00	710.59	714.18		714.23	0.001762	2.09	154.43	121.15	0.33
33.00	710.65	712.35		712.37	0.000635	0.95	34.77	41.44	0.18
51.00	710.65	712.58		712.60	0.000780	1.14	44.71	47.20	0.21
82.00	710.65	712.86		712.89	0.000950	1.38	59.41	54.62	0.23
112.00	710.65	713.09		713.12	0.001090	1.55	72.23	61.86	0.25
165.00	710.65	713.41		713.45	0.001351	1.74	94.74	80.11	0.28
215.00	710.65	713.64		713.70	0.001501	1.85	115.35	95.35	0.30
323.00	710.65	714.05		714.12	0.001579	2.02	160.02	122.01	0.31
33.00	711.13	712.19		712.25	0.004688	1.90	17.33	32.63	0.46
51.00	711.13	712.40		712.46	0.004373	2.06	24.54	38.43	0.45
82.00	711.13	712.67		712.75	0.004052	2.29	35.86	46.03	0.45
112.00	711.13	712.87		712.96	0.004055	2.42	46.24	54.41	0.46
165.00	711.13	713.17		713.27	0.003875	2.56	64.36	67.22	0.46
215.00	711.13	713.40		713.51	0.003720	2.67	80.59	76.91	0.46
323.00	711.13	713.81		713.92	0.003537	2.76	117.18	102.58	0.45
33.00	710.54	711.67		711.77	0.007631	2.53	13.04	23.02	0.59
51.00	710.54	711.86		711.99	0.008161	2.89	17.63	26.76	0.63
82.00	710.54	712.10		712.27	0.008575	3.32	24.70	31.69	0.66
112.00	710.54	712.28		712.45	0.008857	3.63	30.86	35.48	0.69
165.00	710.54	712.55		712.80	0.009234	4.01	41.12	41.96	0.71
215.00	710.54	712.75		713.04	0.009204	4.25	50.54	47.14	0.72
323.00	710.54	713.19		713.46	0.009526	4.21	76.72	75.26	0.73
33.00	710.54	711.67		711.77	0.007744	2.54	12.97	22.96	0.60
51.00	710.54	711.85		711.98	0.008271	2.91	17.54	26.70	0.63
82.00	710.54	712.09		712.27	0.008678	3.33	24.59	31.62	0.67
112.00	710.54	712.28		712.48	0.008950	3.64	30.74	35.39	0.69
165.00	710.54	712.54		712.79	0.009324	4.03	40.97	41.87	0.72
215.00	710.54	712.75		713.04	0.009287	4.27	50.37	47.05	0.73
323.00	710.54	713.19		713.46	0.009720	4.23	76.43	75.10	0.74
33.00	710.43	711.26		711.31	0.003601	1.69	19.57	36.27	0.40
51.00	710.43	711.44		711.50	0.003698	1.94	26.38	40.54	0.42
82.00	710.43	711.67		711.75	0.003850	2.25	36.48	46.18	0.45
112.00	710.43	711.85		711.95	0.003960	2.48	45.22	50.55	0.46
165.00	710.43	712.11		712.23	0.004179	2.81	58.76	58.85	0.49
215.00	710.43	712.31		712.45	0.004425	3.04	70.68	63.06	0.51
323.00	710.43	712.66		712.84	0.004906	3.35	96.34	80.32	0.54
33.00	709.57	710.36	710.36	710.56	0.025170	3.61	9.14	23.26	1.01
51.00	709.57	710.51	710.51	710.75	0.023601	3.93	12.98	27.72	1.01
82.00	709.57	710.70	710.70	710.99	0.022038	4.31	19.02	33.56	1.01
112.00	709.57	710.86	710.86	711.18	0.021429	4.56	24.54	38.92	1.01
165.00	709.57	711.07	711.07	711.44	0.020699	4.85	34.04	48.06	1.01
215.00	709.57	711.23	711.23	711.64	0.020131	5.09	42.26	54.32	1.02
323.00	709.57	711.51	711.51	711.98	0.019298	5.53	58.46	64.35	1.02

*

Just upstream of weir

Conditions of Sleepy Hollow Ditch with Weir – Model Output

HEC-RAS Plan: Cedar River: Cedar Lake River Reach: 1

Reach	River Sta	Profile	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
		33.00	713.94	715.30		715.33	0.001755	1.37	24.06	35.44	0.29
		51.00	713.94	715.54		715.58	0.001795	1.52	33.57	43.13	0.30
		82.00	713.94	715.90		715.94	0.001604	1.59	51.58	56.92	0.29
		112.00	713.94	716.29		716.32	0.001073	1.46	76.59	70.88	0.25
		165.00	713.94	716.86		716.89	0.000659	1.36	121.52	87.19	0.20
		215.00	713.94	717.45		717.47	0.000420	1.20	178.80	109.87	0.17
		323.00	713.94	718.66		718.67	0.000145	0.99	346.53	167.97	0.11
		33.00	713.53	714.78		714.83	0.003400	1.80	18.34	29.48	0.40
		51.00	713.53	715.08		715.13	0.002492	1.80	28.27	35.85	0.36
		82.00	713.53	715.57		715.62	0.001481	1.71	48.02	44.74	0.29
		112.00	713.53	716.06		716.08	0.001211	1.26	89.16	113.49	0.25
		165.00	713.53	716.77		716.78	0.000351	0.89	185.27	156.13	0.14
		215.00	713.53	717.41		717.41	0.000172	0.72	300.47	206.27	0.10
		323.00	713.53	718.65		718.65	0.000051	0.51	639.07	323.17	0.06
		33.00	713.30	714.22	714.19	714.55	0.017851	4.56	7.23	23.21	0.95
		51.00	713.30	714.50	714.43	714.91	0.014338	5.08	10.03	30.23	0.89
		82.00	713.30	714.96	714.77	715.45	0.010699	5.63	14.56	41.82	0.82
		112.00	713.30	715.37	715.07	715.93	0.008674	5.99	18.70	72.10	0.77
		165.00	713.30	716.01	715.53	716.68	0.007079	6.58	25.08	118.95	0.73
		215.00	713.30	716.54	715.92	717.32	0.006348	7.08	30.37	148.12	0.72
		323.00	713.30	717.57	716.68	718.55	0.005400	7.94	40.70	233.94	0.69
		Culvert									
		33.00	713.07	714.21	713.94	714.39	0.006871	3.43	9.63	32.11	0.62
		51.00	713.07	714.36	714.18	714.69	0.010107	4.58	11.14	39.09	0.76
		82.00	713.07	714.53	714.53	715.16	0.016157	6.37	12.87	46.25	0.99
		112.00	713.07	714.82	714.82	715.61	0.015502	7.13	15.71	58.18	1.00
		165.00	713.07	715.29	715.29	716.30	0.014121	8.10	20.38	87.72	1.00
		215.00	713.07	715.67	715.67	716.89	0.013491	8.88	24.22	108.50	1.01
		323.00	713.07	716.44	716.44	718.03	0.012134	10.12	31.92	149.14	1.00
		33.00	712.83	714.30		714.31	0.000632	0.88	37.69	50.63	0.18
		51.00	712.83	714.54		714.56	0.000662	1.00	51.09	58.42	0.19
		82.00	712.83	714.85		714.87	0.000776	1.16	70.78	72.89	0.21
		112.00	712.83	715.06		715.09	0.000886	1.27	87.86	86.60	0.22
		165.00	712.83	715.37		715.40	0.000915	1.41	116.67	100.83	0.23
		215.00	712.83	715.70		715.73	0.000764	1.41	152.68	115.96	0.22
		323.00	712.83	716.04		716.09	0.000896	1.65	195.22	131.19	0.24
		33.00	713.09	714.07		714.17	0.009401	2.55	12.92	26.34	0.64
		51.00	713.09	714.34		714.43	0.006175	2.45	20.84	33.06	0.54
		82.00	713.09	714.62		714.72	0.005332	2.65	30.98	39.15	0.52
		112.00	713.09	714.79		714.93	0.005581	2.93	38.26	42.99	0.55
		165.00	713.09	715.07		715.23	0.005498	3.23	51.11	49.04	0.56
		215.00	713.09	715.46		715.60	0.003740	2.99	72.02	58.21	0.47
		323.00	713.09	715.71		715.92	0.005083	3.70	87.18	64.16	0.56
		33.00	712.23	714.00		714.02	0.000580	0.99	33.44	35.05	0.18
		51.00	712.23	714.25		714.27	0.000700	1.20	42.51	38.26	0.20
		82.00	712.23	714.50		714.54	0.001003	1.56	52.41	41.48	0.25
		112.00	712.23	714.63		714.69	0.001403	1.93	58.10	43.23	0.29
		165.00	712.23	714.86		714.95	0.001943	2.42	68.27	46.18	0.35
		215.00	712.23	715.12		715.21	0.005139	2.36	90.98	132.60	0.50
		323.00	712.23	715.32		715.43	0.005671	2.73	118.13	148.99	0.54
		33.00	712.45	713.94		713.96	0.001352	1.28	25.76	34.54	0.26
		51.00	712.45	714.17		714.21	0.001830	1.43	35.66	50.87	0.30
		82.00	712.45	714.40		714.44	0.002427	1.66	49.28	69.27	0.35
		112.00	712.45	714.50		714.56	0.003280	1.97	56.79	77.58	0.41
		165.00	712.45	714.68		714.75	0.006269	2.16	76.35	147.92	0.53
		215.00	712.45	714.76		714.85	0.007038	2.43	88.51	156.95	0.57
		323.00	712.45	714.93		715.05	0.006996	2.76	116.89	170.08	0.59
		33.00	712.75	713.58	713.58	713.80	0.024759	3.71	8.90	21.46	1.01
		51.00	712.75	713.75	713.75	713.99	0.022255	3.97	12.84	25.77	0.99
		82.00	712.75	714.06	714.06	714.18	0.031569	2.72	30.10	138.60	1.03
		112.00	712.75	714.13	714.12	714.25	0.026124	2.83	39.52	148.74	0.97

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
		165.00	712.75	714.31		714.40	0.010608	2.47	66.74	156.82	0.67
		215.00	712.75	714.52		714.59	0.004889	2.13	101.07	166.45	0.48
		323.00	712.75	714.69		714.78	0.005167	2.50	129.04	173.56	0.51
		33.00	711.66	712.64		712.85	0.019417	3.66	9.02	18.41	0.92
		51.00	711.66	713.06		713.18	0.007048	2.79	18.28	26.22	0.59
		82.00	711.66	713.32		713.48	0.007501	3.16	25.97	32.44	0.62
		112.00	711.66	713.52		713.70	0.008010	3.40	32.96	38.75	0.65
		165.00	711.66	713.79		714.00	0.008252	3.69	44.71	47.51	0.67
		215.00	711.66	714.07		714.24	0.016620	3.32	64.70	136.49	0.85
		323.00	711.66	714.43		714.55	0.006121	2.73	118.19	158.05	0.56
		33.00	710.59	712.72		712.73	0.000312	0.75	43.97	43.66	0.13
		51.00	710.59	713.08		713.09	0.000326	0.83	61.55	54.45	0.14
		82.00	710.59	713.35		713.36	0.000488	1.06	77.11	63.64	0.17
		112.00	710.59	713.53		713.56	0.000689	1.25	89.86	75.70	0.20
		165.00	710.59	713.79		713.83	0.000965	1.47	112.18	94.98	0.24
		215.00	710.59	714.00		714.04	0.001124	1.62	133.03	109.67	0.26
		323.00	710.59	714.33		714.39	0.001308	1.86	173.56	129.73	0.28
		33.00	710.65	712.70		712.71	0.000231	0.65	50.95	50.49	0.11
		51.00	710.65	713.06		713.07	0.000236	0.72	70.77	60.76	0.12
		82.00	710.65	713.31		713.33	0.000391	0.94	87.62	74.16	0.15
		112.00	710.65	713.49		713.51	0.000540	1.11	101.32	85.23	0.18
		165.00	710.65	713.73		713.76	0.000752	1.33	123.95	101.08	0.21
		215.00	710.65	713.92		713.96	0.000893	1.49	144.57	113.65	0.23
		323.00	710.65	714.24		714.29	0.001094	1.75	184.24	131.80	0.26
		33.00	711.13	712.67		712.68	0.000653	0.92	35.94	46.07	0.18
		51.00	711.13	713.03		713.04	0.000542	0.92	55.28	61.14	0.17
		82.00	711.13	713.26		713.28	0.000752	1.16	70.79	71.22	0.20
		112.00	711.13	713.42		713.45	0.000956	1.36	82.33	77.88	0.23
		165.00	711.13	713.63		713.68	0.001316	1.64	100.44	91.02	0.28
		215.00	711.13	713.81		713.86	0.001567	1.83	117.19	102.59	0.30
		323.00	711.13	714.10		714.17	0.001948	2.15	150.07	121.76	0.34
		33.00	710.54	712.64	711.46	712.64	0.000293	0.73	44.97	44.15	0.13
		51.00	710.54	713.00	711.63	713.01	0.000353	0.80	63.39	62.38	0.14
		82.00	710.54	713.21	711.85	713.23	0.000585	1.04	78.52	76.36	0.18
		112.00	710.54	713.35	712.03	713.38	0.000783	1.25	89.56	82.70	0.21
		165.00	710.54	713.54	712.28	713.58	0.001110	1.56	105.89	91.35	0.26
		215.00	710.54	713.69	712.48	713.74	0.001410	1.79	120.25	100.99	0.29
		323.00	710.54	713.94	712.85	714.01	0.001943	2.19	147.59	116.43	0.34
		Inline Weir									
		33.00	710.54	711.67		711.77	0.007744	2.54	12.97	22.96	0.60
		51.00	710.54	711.85		711.98	0.008271	2.91	17.54	26.70	0.63
		82.00	710.54	712.09		712.27	0.008678	3.33	24.59	31.62	0.67
		112.00	710.54	712.28		712.48	0.008950	3.64	30.74	35.39	0.69
		165.00	710.54	712.54		712.79	0.009324	4.03	40.97	41.87	0.72
		215.00	710.54	712.75		713.04	0.009288	4.27	50.36	47.04	0.73
		323.00	710.54	713.19		713.46	0.009720	4.23	76.43	75.10	0.74
		33.00	710.43	711.26		711.31	0.003601	1.69	19.57	36.27	0.40
		51.00	710.43	711.44		711.50	0.003698	1.94	26.36	40.54	0.42
		82.00	710.43	711.67		711.75	0.003850	2.25	36.48	46.18	0.45
		112.00	710.43	711.85		711.95	0.003960	2.48	45.22	50.55	0.46
		165.00	710.43	712.11		712.23	0.004179	2.81	58.76	56.65	0.49
		215.00	710.43	712.31		712.45	0.004427	3.04	70.67	63.08	0.51
		323.00	710.43	712.66		712.84	0.004907	3.35	96.34	80.32	0.54
		33.00	709.57	710.36	710.36	710.56	0.025170	3.61	9.14	23.26	1.01
		51.00	709.57	710.51	710.51	710.75	0.023601	3.93	12.98	27.72	1.01
		82.00	709.57	710.70	710.70	710.99	0.022038	4.31	19.02	33.56	1.01
		112.00	709.57	710.86	710.86	711.18	0.021429	4.56	24.54	38.92	1.01
		165.00	709.57	711.07	711.07	711.44	0.020699	4.85	34.04	48.06	1.01
		215.00	709.57	711.24	711.24	711.64	0.020106	5.09	42.28	54.34	1.02
		323.00	709.57	711.51	711.51	711.98	0.019290	5.52	58.47	64.35	1.02

HEC-RAS Estimate of Water Elevation Change from Addition of Weir to Sleepy Hollow Ditch

		Data without weir		Data w/ weir		
Profile	Storm Duration	Total Flow (cfs)	Water Surface Elevation (ft)	Water Surface Elevation (ft)	Distance to next profile (ft)	Difference in Water Surface Elevation (ft) (ft)
2	1-yr, 3-hr	33	715.3	715.3	212	0
	2-yr, 3-hr	51	715.54	715.54		0
	5-yr, 3-hr	82	715.9	715.9		0
	10-yr, 3-hr	112	716.29	716.29		0
	25-yr, 3-hr	165	716.86	716.86		0
	50-yr, 3-hr	215	717.45	717.45		0
	100-yr, 3-hr	323	718.66	718.66		0
1	1-yr, 3-hr	33	714.78	714.78	38.3	0
	2-yr, 3-hr	51	715.08	715.08		0
	5-yr, 3-hr	82	715.57	715.57		0
	10-yr, 3-hr	112	716.06	716.06		0
	25-yr, 3-hr	165	716.77	716.77		0
	50-yr, 3-hr	215	717.41	717.41		0
	100-yr, 3-hr	323	718.65	718.65		0
0.3	1-yr, 3-hr	33	714.22	714.22	55	0
	2-yr, 3-hr	51	714.5	714.5		0
	5-yr, 3-hr	82	714.96	714.96		0
	10-yr, 3-hr	112	715.37	715.37		0
	25-yr, 3-hr	165	716.01	716.01		0
	50-yr, 3-hr	215	716.54	716.54		0
	100-yr, 3-hr	323	717.57	717.57		0
			Culvert			
-0.3	1-yr, 3-hr	33	714.21	714.21	21.7	0
	2-yr, 3-hr	51	714.36	714.36		0
	5-yr, 3-hr	82	714.53	714.53		0
	10-yr, 3-hr	112	714.82	714.82		0
	25-yr, 3-hr	165	715.29	715.29		0
	50-yr, 3-hr	215	715.67	715.67		0
	100-yr, 3-hr	323	716.44	716.44		0
-1	1-yr, 3-hr	33	714.3	714.3	82	0
	2-yr, 3-hr	51	714.54	714.54		0
	5-yr, 3-hr	82	714.84	714.85		0.01
	10-yr, 3-hr	112	715.06	715.06		0
	25-yr, 3-hr	165	715.37	715.37		0
	50-yr, 3-hr	215	715.7	715.7		0
	100-yr, 3-hr	323	716.04	716.04		0
-2	1-yr, 3-hr	33	714.07	714.07	86	0
	2-yr, 3-hr	51	714.34	714.34		0
	5-yr, 3-hr	82	714.6	714.62		0.02
	10-yr, 3-hr	112	714.78	714.79		0.01
	25-yr, 3-hr	165	715.07	715.07		0
	50-yr, 3-hr	215	715.46	715.46		0
	100-yr, 3-hr	323	715.71	715.71		0

		Data without weir		Data w/ weir		
Profile	Storm Duration	Total Flow (cfs)	Water Surface Elevation (ft)	Water Surface Elevation (ft)	Distance to next profile (ft)	Difference in Water Surface Elevation (ft) (ft)
-3	1-yr, 3-hr	33	714	714	61	0
	2-yr, 3-hr	51	714.25	714.25		0
	5-yr, 3-hr	82	714.48	714.5		0.02
	10-yr, 3-hr	112	714.62	714.63		0.01
	25-yr, 3-hr	165	714.86	714.86		0
	50-yr, 3-hr	215	715.13	715.12		-0.01
	100-yr, 3-hr	323	715.32	715.32		0
-4	1-yr, 3-hr	33	713.94	713.94	43	0
	2-yr, 3-hr	51	714.17	714.17		0
	5-yr, 3-hr	82	714.38	714.4		0.02
	10-yr, 3-hr	112	714.48	714.5		0.02
	25-yr, 3-hr	165	714.67	714.68		0.01
	50-yr, 3-hr	215	714.75	714.76		0.01
	100-yr, 3-hr	323	714.93	714.93		0
-5	1-yr, 3-hr	33	713.6	713.58	41	-0.02
	2-yr, 3-hr	51	713.75	713.75		0
	5-yr, 3-hr	82	714.11	714.06		-0.05
	10-yr, 3-hr	112	714.19	714.13		-0.06
	25-yr, 3-hr	165	714.34	714.31		-0.03
	50-yr, 3-hr	215	714.47	714.52		0.05
	100-yr, 3-hr	323	714.68	714.69		0.01
-6	1-yr, 3-hr	33	712.61	712.64	59	0.03
	2-yr, 3-hr	51	712.79	713.06		0.27
	5-yr, 3-hr	82	713.02	713.32		0.3
	10-yr, 3-hr	112	713.21	713.52		0.31
	25-yr, 3-hr	165	713.48	713.79		0.31
	50-yr, 3-hr	215	713.76	714.07		0.31
	100-yr, 3-hr	323	714.32	714.43		0.11
-7	1-yr, 3-hr	33	712.4	712.72	79	0.32
	2-yr, 3-hr	51	712.64	713.08		0.44
	5-yr, 3-hr	82	712.94	713.35		0.41
	10-yr, 3-hr	112	713.18	713.53		0.35
	25-yr, 3-hr	165	713.52	713.79		0.27
	50-yr, 3-hr	215	713.76	714		0.24
	100-yr, 3-hr	323	714.18	714.33		0.15
-8	1-yr, 3-hr	33	712.35	712.7	82	0.35
	2-yr, 3-hr	51	712.58	713.06		0.48
	5-yr, 3-hr	82	712.86	713.31		0.45
	10-yr, 3-hr	112	713.09	713.49		0.4
	25-yr, 3-hr	165	713.41	713.73		0.32
	50-yr, 3-hr	215	713.64	713.92		0.28
	100-yr, 3-hr	323	714.05	714.24		0.19
-9	1-yr, 3-hr	33	712.19	712.67	81	0.48
	2-yr, 3-hr	51	712.4	713.03		0.63
	5-yr, 3-hr	82	712.67	713.26		0.59
	10-yr, 3-hr	112	712.87	713.42		0.55
	25-yr, 3-hr	165	713.17	713.63		0.46

		Data without weir		Data w/ weir		
Profile	Storm Duration	Total Flow (cfs)	Water Surface Elevation (ft)	Water Surface Elevation (ft)	Distance to next profile (ft)	Difference in Water Surface Elevation (ft) (ft)
	50-yr, 3-hr	215	713.4	713.81		0.41
	100-yr, 3-hr	323	713.81	714.1		0.29
-9.8	1-yr, 3-hr	33	711.67	712.64	0.4	0.97
	2-yr, 3-hr	51	711.86	713		1.14
	5-yr, 3-hr	82	712.1	713.21		1.11
	10-yr, 3-hr	112	712.28	713.35		1.07
	25-yr, 3-hr	165	712.55	713.54		0.99
	50-yr, 3-hr	215	712.76	713.69		0.93
	100-yr, 3-hr	323	713.19	713.94		0.75
			weir			
-10	1-yr, 3-hr	33	711.67	711.67	88	0
	2-yr, 3-hr	51	711.85	711.85		0
	5-yr, 3-hr	82	712.09	712.09		0
	10-yr, 3-hr	112	712.28	712.28		0
	25-yr, 3-hr	165	712.54	712.54		0
	50-yr, 3-hr	215	712.75	712.75		0
	100-yr, 3-hr	323	713.19	713.19		0
-11	1-yr, 3-hr	33	711.26	711.26	96	0
	2-yr, 3-hr	51	711.44	711.44		0
	5-yr, 3-hr	82	711.67	711.67		0
	10-yr, 3-hr	112	711.85	711.85		0
	25-yr, 3-hr	165	712.11	712.11		0
	50-yr, 3-hr	215	712.31	712.31		0
	100-yr, 3-hr	323	712.66	712.66		0
-12	1-yr, 3-hr	33	710.36	710.36	0	0
	2-yr, 3-hr	51	710.51	710.51		0
	5-yr, 3-hr	82	710.7	710.7		0
	10-yr, 3-hr	112	710.86	710.86		0
	25-yr, 3-hr	165	711.07	711.07		0
	50-yr, 3-hr	215	711.23	711.24		0.01
	100-yr, 3-hr	323	711.51	711.51		0

HEC-RAS Stream Velocity Reduction at the Sleepy Hollow Ditch Weir

Profile	Storm Duration	Total Flow (cfs)	Stream velocity without weir (ft/s)	Stream velocity with weir (ft/s)	Reduction in flow velocity (%)
-9.8	1-yr, 3-hr	33	2.53	0.73	71
	2-yr, 3-hr	51	2.89	0.8	72
	5-yr, 3-hr	82	3.32	1.04	69
	10-yr, 3-hr	112	3.63	1.25	66
	25-yr, 3-hr	165	4.01	1.56	61
	50-yr, 3-hr	215	4.25	1.79	58
	100-yr, 3-hr	323	4.21	2.19	48

APPENDIX B

Sleepy Hollow Ditch Stilling Basin Settling Calculations

1-Year 3-hr Design Storm Flow

1-year Storm Sediment Discharge (tons)
31

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	100.00	99.59	81.83	2.71
X		29.34	14.45	5.49	1.71	0.03
l	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	0.73	0.73	0.73	0.73	0.73
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	4.28	4.81	1.94	4.19	9.85
Sd	Sediment Deposited (tons)	4.3	4.8	1.9	3.4	0.3

Removal Efficiency (%) **47**

Average flow velocity comes from HEC-RAS model

2-Year 3-hr Design Storm Flow

2-year Storm Sediment Discharge (tons)
42

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	100.00	99.33	78.90	2.47
X		26.77	13.19	5.01	1.56	0.03
l	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	0.80	0.80	0.80	0.80	0.80
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	5.79	6.51	2.63	5.67	13.34
Sd	Sediment Deposited (tons)	5.8	6.5	2.6	4.5	0.3

Removal Efficiency (%) **47**

Average flow velocity comes from HEC-RAS model

5-Year 3-hr Design Storm Flow

5-year Storm Sediment Discharge (tons)

61

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	100.00	97.88	69.79	1.91
X		20.59	10.14	3.85	1.20	0.02
I	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	1.04	1.04	1.04	1.04	1.04
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	8.41	9.46	3.82	8.24	19.38
Sd	Sediment Deposited (tons)	8.4	9.5	3.7	5.8	0.4

Removal Efficiency (%) **45**

Average flow velocity comes from HEC-RAS model

10-Year 3-hr Design Storm Flow

10-year Storm Sediment Discharge (tons)

80

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	99.98	95.95	63.06	1.59
X		17.13	8.44	3.21	1.00	0.02
I	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	1.25	1.25	1.25	1.25	1.25
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	11.03	12.40	5.02	10.81	25.41
Sd	Sediment Deposited (tons)	11.0	12.4	4.8	6.8	0.4

Removal Efficiency (%) **44**

Average flow velocity comes from HEC-RAS model

25-Year 3-hr Design Storm Flow

25-year Storm Sediment Discharge (tons)
116

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	99.88	92.35	54.98	1.28
X		13.73	6.76	2.57	0.80	0.01
I	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	1.56	1.56	1.56	1.56	1.56
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	16.00	17.98	7.27	15.67	36.85
Sd	Sediment Deposited (tons)	16.0	18.0	6.7	8.6	0.5

Removal Efficiency (%) **43**

Average flow velocity comes from HEC-RAS model

50-Year 3-hr Design Storm Flow

50-year Storm Sediment Discharge (tons)
152

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	100.00	99.72	89.35	50.12	1.11
X		11.96	5.89	2.24	0.70	0.01
I	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	1.79	1.79	1.79	1.79	1.79
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	20.96	23.56	9.53	20.53	48.29
Sd	Sediment Deposited (tons)	21.0	23.5	8.5	10.3	0.5

Removal Efficiency (%) **42**

Average flow velocity comes from HEC-RAS model

100-Year 3-hr Design Storm Flow

100-year Storm Sediment Discharge (tons)

196

		Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Fine Silt
P	(%material deposited over basin length)	99.99	99.19	83.97	43.36	0.91
X		9.78	4.82	1.83	0.57	0.01
l	(basin length in feet)	300.00	300.00	300.00	300.00	300.00
Vs	(settling velocity ft/s)	0.20	0.10	0.04	0.01	0.00
D	(particle size mm)	0.50	0.25	0.13	0.06	0.01
V	(average flow velocity ft/s)	2.19	2.19	2.19	2.19	2.19
d	(water depth ft)	3	3	3	3	3
%S	Percent of total sediment	13.79	15.50	6.27	13.51	31.77
Si	Sediment Inflow (tons)	27.03	30.38	12.29	26.48	62.27
Sd	Sediment Deposited (tons)	27.0	30.1	10.3	11.5	0.6

Removal Efficiency (%) **41**

Average flow velocity comes from HEC-RAS model

APPENDIX C

HARZA

Consulting Engineers and Scientists

June 2, 1998

Mr. David Hudak
U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121

Dear Mr. Hudak:

I would like to request information on the presence of threatened and endangered species, potential impacts on threatened and endangered species, high quality natural areas, and natural areas within the Cedar Lake drainage basin in Lake County, Indiana. I have attached two figures which show the location of the area of interest.

Harza has proposed a project which would decrease the sediment load which enters Cedar Lake through the streams on the west side of the Lake. The project would involve the placement of some type of structure which would impede the flow in these inlet streams as to allow the suspended particles to settle out before entering Cedar Lake.

I greatly appreciate your assistance in this matter and if you have any questions please contact me at (312) 831-3055. Thank you very much.

Very truly yours,

Edward J. Belmonte
Environmental Scientist

Harza Environmental Services, Inc.
Sears Tower 233 South Wacker Drive Chicago, Illinois 60606-6392
Tel: (312) 831-3800 Fax: (312) 831-3999 Telex: 25-3540

CHAPTER 1: LAKE SETTING

1.0 LOCATION

Cedar Lake is located in west central Lake County, T34N, R9W, Sections 22, 23, 26, 27, 34 and 35. It lies approximately 4.5 miles southwest of Crown Point and forty miles southeast of Chicago. U.S. Route 41 (Wicker Street), Lake Shore Drive and Parrish Street, 133rd Avenue, Morse Street, and Cline Avenue provide the principal automobile access to Cedar Lake (Figure 1-1).

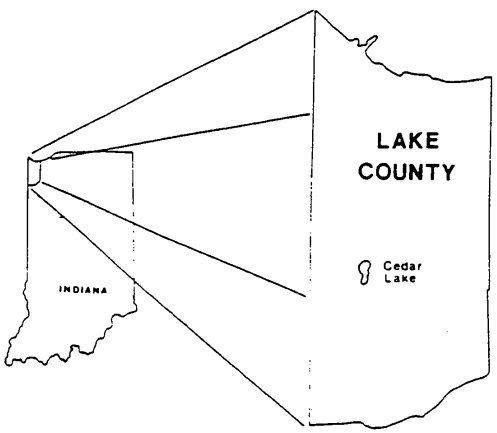


Figure 1-1. Location map.

1.1 LAKE MORPHOMETRY

Cedar Lake has a three-lobed shape that can be seen on the bathymetric map presented as Figure 1-2. The following morphometric parameters have been determined from the map:

Maximum Length	3.4 kilometers (2.1 miles)
Maximum Width	1.5 kilometers (0.9 miles)
Surface Area	316 hectares (781 acres)
Volume	8.44 X $10^6 m^3$ (6841 acre feet)
Maximum Depth	4.9 meters (16 feet)
Mean Depth	2.7 meters (8.8 feet)
Shore Line	9.5 kilometers (5.9 miles)
Shoreline Development Ratio	1.52

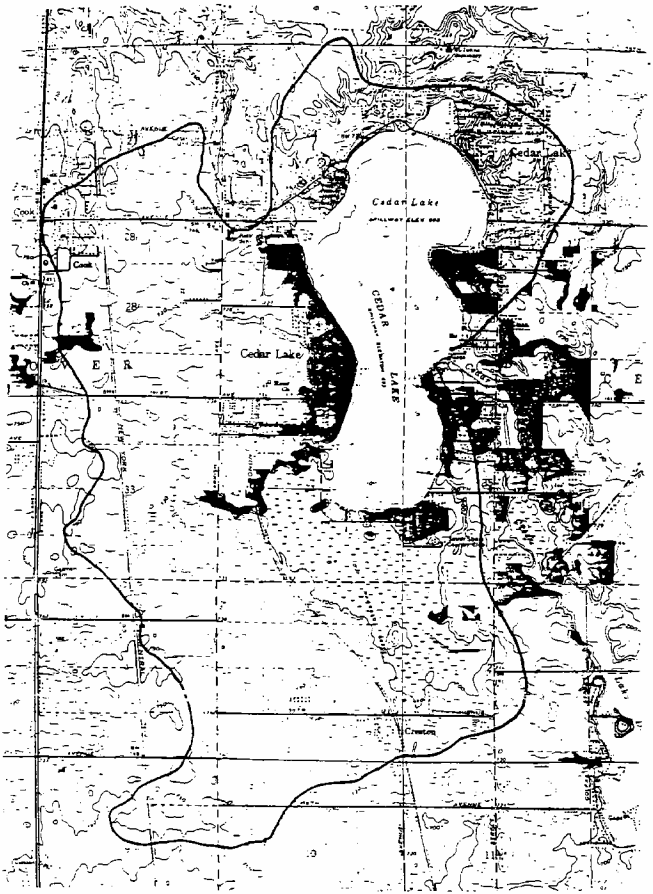


Figure 1-4. Cedar Lake drainage basin.

INDIANA DEPARTMENT OF NATURAL RESOURCES

LARRY D. MACKLIN, DIRECTOR

Division of Nature Preserves
402 W. Washington St., Rm. 267
Indianapolis, Indiana 46204
317-232-4052

March 26, 1998

Mr. Ed Belmonte
Harza Consulting Engineering and Scientists
Sears Tower
233 South Wacker Drive
Chicago, IL 60606-6392

Dear Mr. Belmonte:

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from the Cedar Lake watershed, Lake County, Indiana. The Indiana Natural Heritage Data Center has been checked and enclosed you will find information on the ETR species and significant areas documented from this area.

For more information on the animal species mentioned, please contact Katie Smith, Nongame Supervisor, Division of Fish and Wildlife, 402 W. Washington Room W273, Indianapolis, Indiana 46204, (317)232-4080.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. You should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
(812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

Larry Macklin, Director
Department of Natural Resources
attn: Stephen H. Jose
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-4080

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-4052 if you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

enclosure: data sheet

March 26, 1998

ENDANGERED, THREATENED, AND RARE SPECIES
AND HIGH QUALITY NATURAL COMMUNITIES AND NATURAL AREAS DOCUMENTED FROM
THE CEDAR LAKE WATERSHED, LAKE COUNTY, INDIANA

Type.....	Element Name.....	Common Name.....	State	Fed..	Townrang Sec.....		Date	Comments
LOWELL QUADRANGLE								
High Quality Community	WETLAND - MARSH	MARSH	SG	**	034N009W 34 033N009W 02	NH SEQ WH NWQ	0000	
Plant	ZANNICHELLIA PALUSTRIS	HORNED PONDWEED	SE	**	033N009W 03 034N009W 34	NEQ NEQ CENTER	1930	

STATE: SX=extirpated, SE=endangered, ST=threatened, SR=rare, SSC=special concern, WL=watch list, SG=significant, SRE=state reintroduced

FEDERAL: LE=endangered, LT=threatened, LELT=different listings for specific ranges of species, PE=proposed endangered, PT=proposed threatened, E/SA=appearance similar to LE species, **=not listed

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, Indiana 47403-2121
(812) 334-4261 FAX 334-4273

IN REPLY REFER TO:

June 29, 1998

Mr. Edward Belmonte
Harza Environmental Services
Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606-6392

Dear Mr. Belmonte:

This responds to your letter of June 2, 1998 requesting preliminary information from the U.S. Fish and Wildlife Service (FWS) for a proposed sediment load reduction project at Cedar Lake in Lake County, Indiana.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

Endangered Species

The proposed project is within the range of the federally endangered Indiana bat (Myotis sodalis) and Karner blue butterfly (Lycaeides melissa samuelis), and federally threatened Meads milkweed (Asclepias meadii). All Karner blue records are from northern Lake and Porter Counties. There are no Indiana bat or Meads milkweed records from the project vicinity. Some bat habitat may exist in forested areas in the lake's watershed, however to our knowledge there have been no survey in the project area.

Attached is a copy of the National Wetland Maps for the project area. We are not aware of any high quality natural areas in the project study area. The German Methodist Cemetery on the west side of U.S. 41 highway contains a remnant prairie plant community.

For further discussion, please contact Mike Litwin at (812) 334-4261 ext. 205. For more detailed project reviews involving site inspections, please contact our Warsaw, Indiana field office at (219) 269-7640.

Sincerely yours,

Michael A. Ritter acting

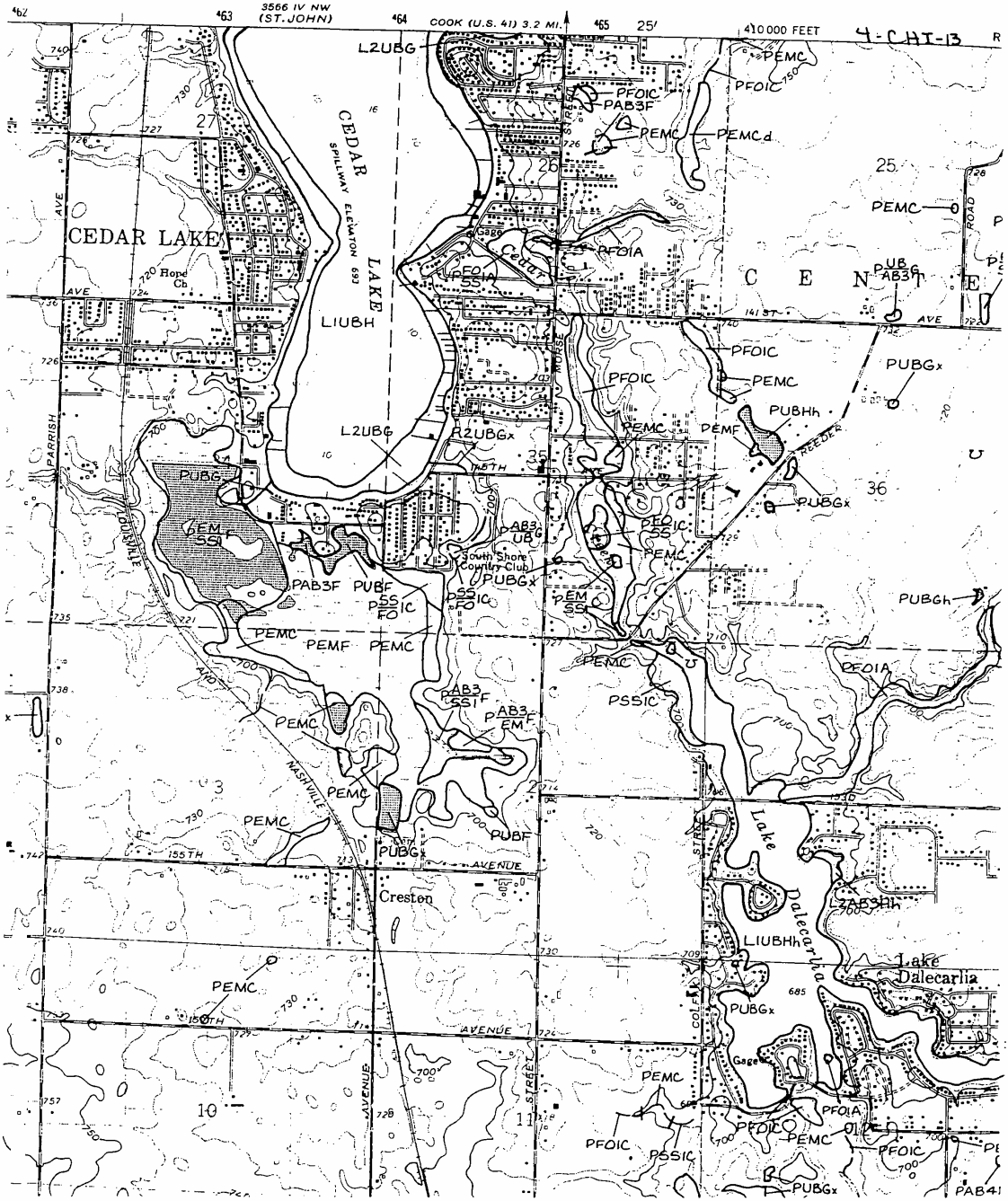
David C. Hudak
Supervisor

cc: IDEM, Office of Water Management (Compliance), Indianapolis, IN
Steve Jose, Indiana Division of Fish and Wildlife, Indianapolis, IN
USFWS, Warsaw, IN

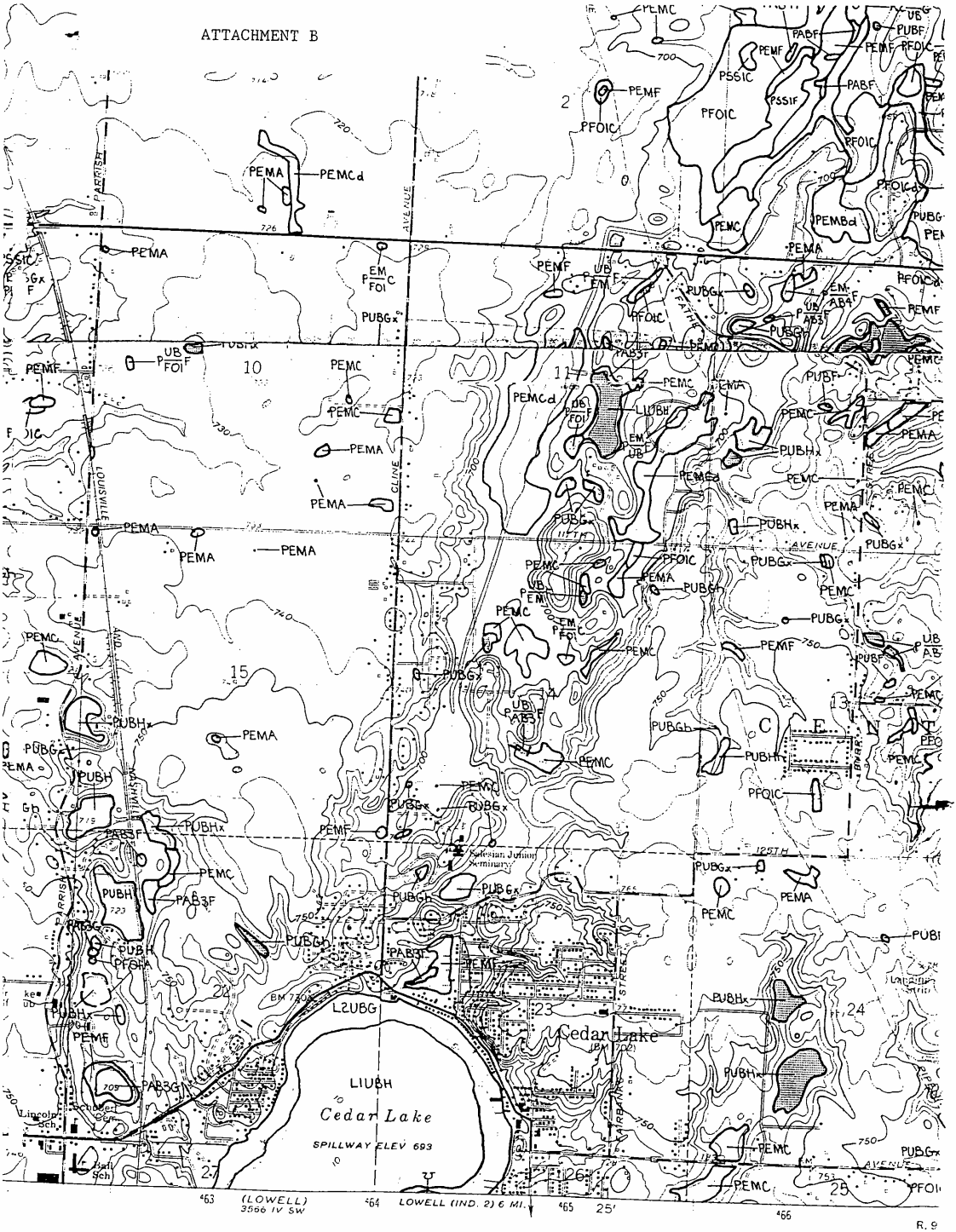
CNAL WETLANDS INVENTORY

ITED STATES DEPARTMENT OF THE INTERIOR

ATTACHMENT A



ATTACHMENT B



APPENDIX D

PROJECT **Contract Drilling Services, Cedar Lake, Indiana**

CLIENT **Montgomery Watson Harza**

BORING **1** DATE STARTED **6-7-02** DATE COMPLETED **6-7-02** JOB **L-55,222**

ELEVATIONS

GROUND SURFACE

END OF BORING

WATER LEVEL OBSERVATIONS

WHILE DRILLING **8.5'**

AT END OF BORING **9.5'**

24 HOURS

SAMPLE NO.	SAMPLE TYPE	LENGTH RECOVERY	N	WC	Qu	γ_{DRY}	DEPTH	ELEV.	SOIL DESCRIPTIONS
							0		
1	SS		8	28.5	2.0*				Black clayey TOPSOIL, moist (OL)
							3.0		
A				20.3	1.0*				
2	SS		4						Tough brown silty CLAY, mottled gray, little sand, trace gravel, moist (CL)
B				21.9	1.0*				
3	ST		Push						
							8.5		▼
4	ST		Push						▽ Very tough to hard gray silty CLAY, little to some sand, trace gravel, occasional sand seams, moist (CL)
5	SS		12	13.6	4.66				
					4.0*				
							13.0		Firm gray clayey SAND, saturated (SC)
A							14.0		
6	SS		14						
B				14.3	2.68				
					2.0*				
7	SS		11	14.9	1.25*				Tough to very tough gray silty CLAY, little to some sand, trace gravel, moist (CL)
8	SS		12	18.2	2.68				
					2.0*				
9	SS		16	14.6	2.0*				
					2.02				
10	SS		15	17.6	1.5*		25		End of Boring at 25.0'

* Approximate unconfined compressive strength based on measurements with a calibrated pocket penetrometer.

DISTANCE BELOW SURFACE IN FEET

0 5 10 15 20 25 30 35 40

DRILL RIG NO. **262**

Division lines between deposits represent approximate boundaries between soil types; in-situ, the transition may be gradual.

TSC 58222.GPJ TSC_ALL.GDT 6/11/02

APPENDIX E

DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
REGULATORY OFFICE
SOUTH BEND FIELD OFFICE
2422 VIRIDIAN DRIVE SUITE # 101
SOUTH BEND, INDIANA 46628

March 26, 2002

IN REPLY REFER TO

File No. 01-145-028-0

Douglas Mulvey
Harza Engineering Company, Inc.
233 S Wacker Dr
Chicago, Illinois 60606-6392

Dear Mr. Mulvey:

Please refer to your application dated March 6, 2002, for a Department of the Army permit to build a weir and place riprap in Sleepy Hollow Ditch at Cedar Lake, Indiana (Section 27, Township 34N, Range 9W).

Under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, Louisville and Detroit Districts issued Regional Permit 99-100-003-0 on Feb 11, 2000, for certain activities having minimal impact in Indiana. We have verified that your proposed work shown on the enclosed plans and described below is authorized under the Regional Permit. You may proceed with the work subject to the enclosed general conditions, any noted special conditions, and Indiana Department of Environmental Management (IDEM) Section 401 Water Quality Certification.

The following work is authorized:

Install in Sleepy Hollow Ditch a sheet-pile weir approximately 50 feet wide and 5 feet high above the bottom of the ditch. Place approximately 600 square feet of riprap (42 cubic yards) within the ditch about the weir.

Special Conditions:

1. All dredged and/or excavated materials shall be disposed of at an upland location above the Ordinary High Water Mark with no placement in, or return to, any waterway or wetland, including Sleepy Hollow Ditch.

2. Comply with all conditions imposed on you by other local, State, or Federal agencies that may issue permits for the project, including those imposed by the Indiana Department of Environmental Management.

Any construction activity other than that shown on the plans may not qualify for the Regional Permit. If you plan changes or additional activities from those depicted on the plans, please submit them to this office for review prior to construction.

Upon completion of the work authorized by this RGP, the enclosed Completion Report form must be completed and returned to this office. This verification is valid until February 11, 2005, or 1 year from the date of this letter, whichever occurs later, unless the regional permit is modified, suspended or revoked.

If you have questions, please contact Steven W. Sprecher at the above address or telephone (574) 232-1952. Please refer to File Number: 01-145-028-0.

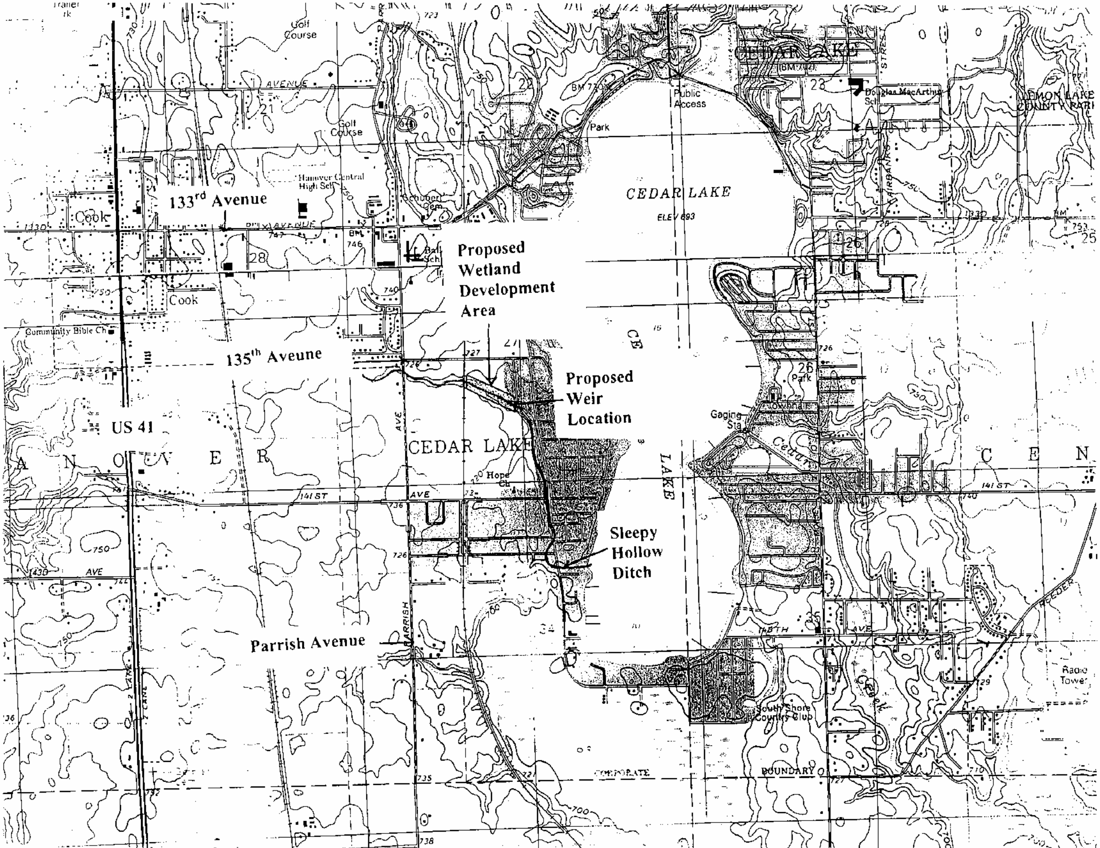
Sincerely,

Gregory A. McKay

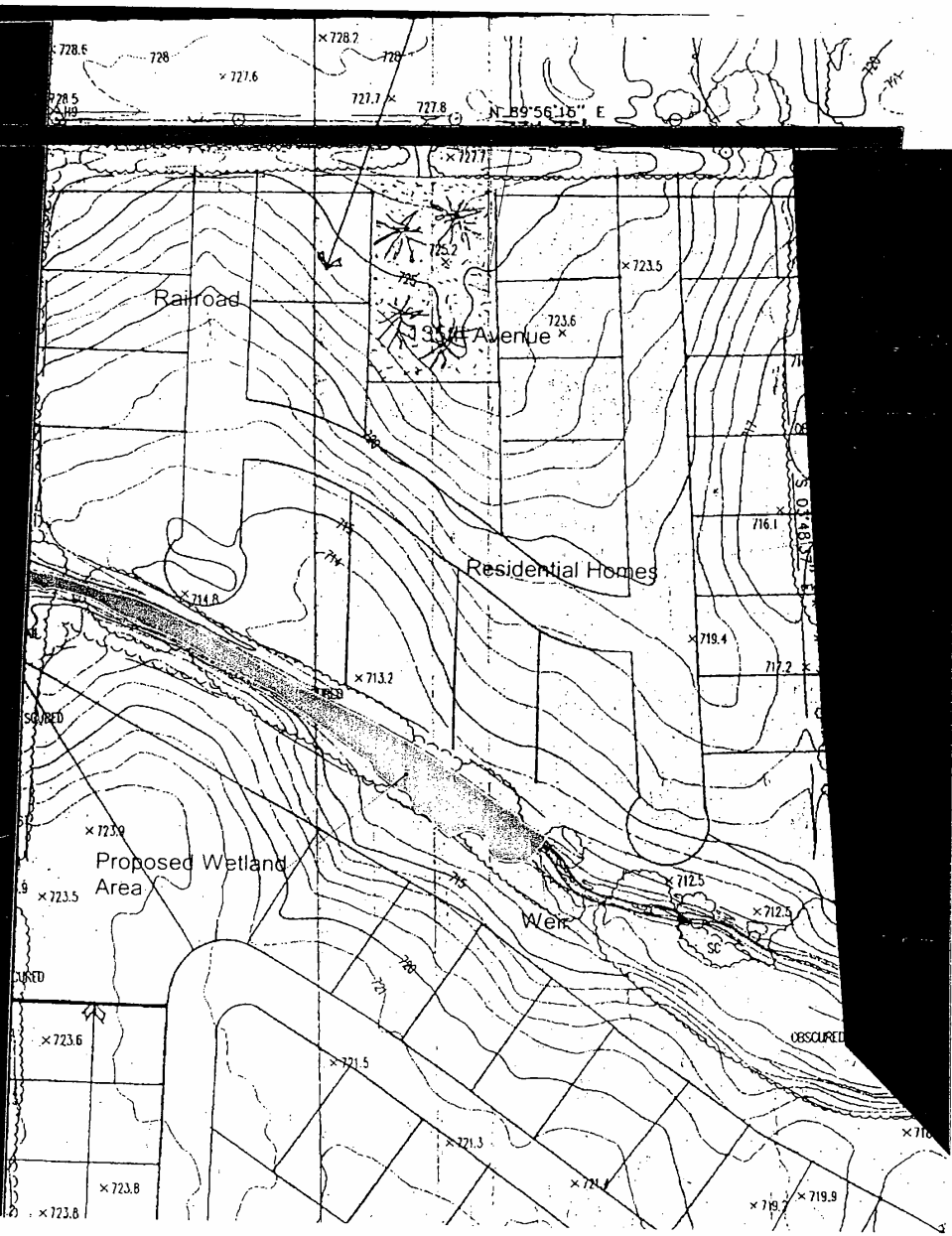
Gregory A. McKay
Project Manager
South Bend Field Office

Enclosures

Copies Furnished
IDEM, Office of Water/Maupin
IDNR, Division of Water
Cedar Lake Enhancement Association/Gross



Proposed
Wetland
Development
Area
Proposed
Weir
Location
Sleepy
Hollow
Ditch
133rd Avenue
135th Aveune
US 41
Parrish Avenue
CEDAR LAKE
ELEV 693
Public
Access
Park
Golf
Course
Hanover Central
High Sch
Cook
Community Bible Ch
Douglas MacArthur
Sch
Gaging
Sta
South Shore
Country Club
Radio
Tower
CORPORATE
BOUNDARY
141 ST



Wetland and Weir Location Map

Approximate Scale: 1" = 150'

HARZA CHICAGO

SUBJECT
COMPUTED DATE
CHECKED DATE
BACKCHECKED DATE

PROJECT NAME
PROJECT NUMBER
Page ____ of ____ Pages

Sleepy Hollow Ditch
WETLAND WEIR
PLAN VIEW

Sheetpile Weir Length = 50 feet

Rip-Rap (Gradation 3)

Scale 1" = 10 feet

QUALITY ENGINEERING - A HARZA TRADITION

General Conditions

1. Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site (i.e. on-site). The permittee shall provide a mitigation/monitoring plan for any activity where the adverse impact on special aquatic sites exceeds 0.10 acre (4,356 sq. ft.) or is determined to be more than minimal impact. In determining the minimal impact threshold, the Districts will consider the direct and secondary impacts of the fill or work and any mitigation measures. A wetland delineation report is also required. NOTE: An important element of any mitigation plan for projects in or near streams, other open waters and wetlands is the requirement for vegetated buffers. Therefore, all mitigation plans should include a minimum 50-foot wide buffer between the edge of the project site and the waters and/or wetlands to be affected unless a lesser distance has been specifically approved under the RGP.

2. The permittee shall, if mitigation is required, develop the mitigation site concurrently with site construction. This will assure that aquatic functions are not lost for long periods of time which could adversely affect water quality and wildlife.

3. The permittee shall ensure that sedimentation and soil erosion control measures are in place prior to any construction activity. This shall include the installation of straw bale barriers, silt fencing and/or other approved methods to control sedimentation and erosion.

4. The permittee shall ensure that areas disturbed by any construction activity, including channel banks, are immediately stabilized and revegetated with a combination of grasses, legumes and shrubs compatible to the affected area.

5. The permittee shall ensure that all in-stream construction activity is not performed during periods of high stream flow or during the fish spawning season between April 1 through June 30 without first contacting the IDNR, Division of Fish and Wildlife for their expertise on impacts to the fishery resource. Additionally, the discharge of dredged and/or fill material in known waterfowl breeding areas must be avoided to the maximum extent practicable.

6. The permittee will ensure that the activity authorized will not disrupt movement of those aquatic species indigenous to the waterbody, including those species which normally migrate through the area unless the activity's specific purpose is to impound water.

7. The permittee shall ensure that all construction equipment is refueled and maintained on an upland site away from existing streams, drainageways and wetland areas. Heavy equipment working in wetlands must be placed on mats, or other measures taken to minimize soil disturbance.

8. The permittee must provide a copy of the site specific State Section 401 WQC (if required) before the Corps will authorize a project under the RGP.

9. The permittee must comply with any case specific special conditions added by the Corps or by the State Section 401 WQC. The conditions imposed in the State Section 401 WQC are also conditions of this RGP.

10. The permittee shall assure that no activity authorized by the RGP may cause more than a minimal adverse effect on navigation.

11. The permittee shall ensure proper maintenance of any structure or fill authorized by this RGP, including maintenance to ensure public safety.

12. The permittee shall not perform any work within any Wild and Scenic Rivers or in any river officially designated as a "study river" for possible inclusion in the system, unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity authorized by the RGP will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal Land Management agency in the area (e.g. U.S. Forest Service, Bureau of Land Management or the U.S. Fish and Wildlife Service).

13. The permittee shall not perform any work under the RGP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. The permittee shall notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work under the RGP until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized. Authorization of an activity under the RGP does not authorize the "take" of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal "takes" of protected species are in violation of the Endangered Species Act.

14. The permittee shall not perform any activity under the RGP which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places until the District Engineer has complied with the provisions of 33 CFR Part 325, Appendix C. The permittee must notify the District Engineer if the activity authorized by the RGP may affect any historic properties listed, determined to be eligible or which the permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin construction until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the Indiana Department of Natural Resources, Division of Historic Preservation and Archaeology.

PERMIT COMPLETION REPORT

Detroit District, Corps of Engineers

CELRE-RG-A-S 01-145-028-0

Commander
U.S. Army Engineer District, Detroit
ATTN: Regulatory Office
P.O. Box 1027
Detroit, Michigan 48231-1027

Dear Sir:

This is in regard to Department of the Army File No. 01-145-028-0, issued to Cedar Lake Enhancement Association, Inc. on March 26, 2002, to build a weir and place riprap in in UNNAMED STREAM at Cedar Lake, Indiana. I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the permit, and mitigation (if required) was completed in accordance with the permit conditions.

The work was completed on: _____
(Date work completed)

_____
(Signature of Permittee) (Date)

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the above address, within 10 days after completion of work.

Please note that your permitted activity is subject to compliance inspection by the U.S. Army Corps of Engineers' representatives. If you fail to comply with this permit you are subject to permit suspension, modification or revocation.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We make Indiana a cleaner, healthier place to live

Frank O'Bannon
Governor

Lori F. Kaplan
Commissioner

100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015
(317) 232-8603
(800) 451-6027
www.state.in.us/idem

VIA CERTIFIED MAIL 7000 0600 0026 4646 2795

April 3, 2002

Mr. Robert Gross
Cedar Lake Enhancement Association
P.O. Box 823
Cedar Lake, IN 46303

Dear Mr. Gross:

Re: Section 401 Water Quality Certification
IDEM No.: 2001-355-45-MTM-A
COE No.: 01-145-028-0
County: Lake

Office of Water Quality staff have reviewed your application for Section 401 Water Quality Certification, received August 3, 2001, regarding a proposal to construct a notched sheetpile weir approximately 40 feet long across Sleepy Hollow Ditch. It is also proposed to widen the channel bottom to 30 feet for a distance of 1000 feet upstream of the location of the weir. We have also reviewed the correspondence, received March 5, 2002, from Mr. Doug Mulvey, MHZ, regarding modifications to the project. According to Mr. Mulvey's correspondence, a 48-foot long notched sheetpile weir will be constructed in the stream but would be integrated into existing topography in a manner which would preclude the need to excavate upstream of the weir.

Based on available information, it is the judgment of this office that the proposed project will comply with the applicable provisions of 327 IAC 2 and Sections 301, 302, 303, 306, and 307 of the Clean Water Act if the recipient of the certification complies with the conditions set forth below. Therefore, subject to the following conditions, the Indiana Department of Environmental Management (IDEM) hereby grants Section 401 Water Quality Certification for the project described in your application, received August 3, 2001 and modifications received March 5, 2002. Any changes in project design or scope not detailed in the application described above or modified by the conditions below are not authorized by this certification.

PROJECT CONDITIONS:

The recipient of the certification shall:

1. Execute the project as described in the application for Section 401 Water Quality Certification, received August 3, 2001; as modified in the correspondence,

received March 5, 2002 from Mr. Doug Mulvey, MHZ; and as modified by this Section 401 Water Quality Certification.

2. Not excavate the channel beyond 50 feet upstream and 50 feet downstream of the location of the weir.

3. Complete the project within two years of the date of this Section 401 Water Quality Certification. If the applicant requires more time to complete the project, the applicant must request, in writing, an extension of this time prior to the expiration date of this Certification. If the applicant does not make this request prior to the expiration date of this Certification, the applicant will be required to submit a new application.

4. Deposit any dredged material in a contained upland disposal area to prevent sediment run-off to any waterbody. Dispose of all dredged and excavated material according to the requirements of 329 IAC 10, governing Solid Waste Land Disposal Facilities. Your project information may be forwarded to the IDEM Office of Land Quality, Industrial Waste Section for review. Sampling may be required to determine if the dredged sediment is contaminated. Failure to properly dispose of contaminated sediment may result in enforcement action against you.

5. Install erosion control methods prior to any soil disturbance to prevent soil from leaving the construction site. Appropriate erosion control methods include, but are not limited to, straw bale barriers, silt fencing, erosion control blankets, phased construction sequencing, and earthen berms. Monitor and maintain erosion control structures and devices regularly, especially after rain events, until all soils disturbed by construction activities have been permanently stabilized.

6. Clearly mark the construction limits shown in the attached plans at the project site during construction.

7. Allow the commissioner or an authorized representative of the commissioner (including an authorized contractor), upon the presentation of credentials:
   A) to enter upon the recipient of the certification's property;
   B) to have access to and copy at reasonable times any records that must be kept under the conditions of this certification;
   C) to inspect, at reasonable times, any monitoring or operational equipment or method; collection, treatment, pollution management or discharge facility or device; practices required by this certification; and any wetland mitigation site;
   D) to sample or monitor any discharge of pollutants or any mitigation site.

This granting of Section 401 Water Quality Certification does not relieve the recipient of the certification from the responsibility of obtaining any other permits or authorizations that may be required for this project or related activities from IDEM or any other agency or person. You

may wish to contact the Indiana Department of Natural Resources at 317-232-4161 concerning the possible requirement of natural freshwater lake or floodway permits, or the IDEM stormwater permits section at 317-232-8648 concerning the possible need for 327 IAC 15-5 (Rule 5) permits if you plan to disturb greater than 5 acres of soil during construction.

This certification does not:

(1) authorize impacts or activities outside the scope of this certification;
(2) authorize any injury to persons or private property or invasion of other private rights, or any infringement of federal, state or local laws or regulations;
(3) convey any property rights of any sort, or any exclusive privileges;
(4) preempt any duty to obtain federal, state or local permits or authorizations required by law for the execution of the project or related activities; or
(5) authorize changes in the plan design detailed in the application.

Failure to comply with the terms and conditions of this Section 401 Water Quality Certification may result in enforcement action against the recipient of the certification. If an enforcement action is pursued, the recipient of the certification could be assessed up to $25,000 per day in civil penalties. The recipient of the certification may also be subject to criminal liability if it is determined that the Section 401 Water Quality Certification was violated willfully or negligently.

This certification is effective 18 days from the mailing of this notice unless a petition for review and a petition for stay of effectiveness are filed within this 18-day period. If a petition for review and a petition for stay of effectiveness are filed within this period, any part of the certification within the scope of the petition for stay is stayed for 15 days, unless or until an Environmental Law Judge further stays the certification in whole or in part.

This decision may be appealed in accordance with IC 4-21.5, the Administrative Orders and Procedures Act. The steps that must be followed to qualify for review are:

1. You must petition for review in a writing that states facts demonstrating that you are either the person to whom this decision is directed, a person who is aggrieved or adversely affected by the decision, or a person entitled to review under any law.

2. You must file the petition for review with the Office of Environmental Adjudication (OEA) at the following address:

   Office of Environmental Adjudication
   ISTA Building
   150 West Market Street
   Suite 618
   Indianapolis, IN 46204

3. You must file the petition within eighteen (18) days of the mailing date of this

decision. If the eighteenth day falls on a Saturday, Sunday, legal holiday, or other day that the OEA offices are closed during regular business hours, you may file the petition the next day that the OEA offices are open during regular business hours. The petition is deemed filed on the earliest of the following dates: the date it is personally delivered to OEA; the date that the envelope containing the petition is postmarked if it is mailed by United States mail; or, the date it is shown to have been deposited with a private carrier on the private carrier's receipt, if sent by private carrier.

Identifying the certification, decision, or other order for which you seek review by number, name of the applicant, location, or date of this notice will expedite review of the petition.

Note that if a petition for review is granted pursuant to IC 4-21.5-3-7, the petitioner will, and any other person may, obtain notice of any prehearing conferences, preliminary hearings, hearings, stays, and any orders disposing of the proceedings by requesting copies of such notices from OEA.

If you have procedural questions regarding filing a petition for review you may contact OEA at 317-232-8591.

If you have any questions about this certification, please contact Mr. Marty Maupin, Project Manager, of my staff at 317-233-2471, or you may contact the Office of Water Quality through the IDEM Environmental Helpline (1-800-451-6027).

Sincerely,

Mary Ellen Gray

Mary Ellen Gray
Deputy Assistant Commissioner
Office of Water Quality

cc: Steve Sprecher, South Bend Office, USACE
Doug Mulvey, MHZ

DNR Indiana Department of Natural Resources

Frank O'Bannon, Governor
Larry D. Macklin, Director
Division of Water
402 W. Washington Street
Room W264
Indianapolis, IN 46204-2748
PH: (317) 232-4160
FAX: (317) 233-4579

May 17, 2001
REC-GN-16383

Harza Engineering Company, Inc.
Douglas L. Mulvey
233 South Wacker Drive
Chicago, IL 60606-6392

Re: Lake - Lowell
O – UNT Cedar Lake
Basin 2

Dear Mr. Mulvey:

Thank you for your April 23, 2001 request for information concerning a tract of land along an unnamed tributary to Cedar Lake. Based on your description, the proposed project site, which lies in Section 27, Township 34N, Range 9W is located approximately 1500' downstream of the Parrish Avenue stream crossing at Cedar Lake, Lake County.

Topographic mapping indicates that the drainage area above the site is less than 1 square mile. Approval of the Department of Natural Resources under IC 14-28-1 is not required for construction, excavation or filling at this site unless a dam is to be constructed. This site may, however, have localized drainage problems, which you may want to address as you develop your project's plans.

The Division of Water does not provide engineering services to develop 100-year frequency flood elevations on sites along streams which have drainage areas of less than one square mile. We consider these sites, with small drainage areas, to be better addressed through local floodplain management and stormwater management ordinances.

You may have to obtain a permit from the Corps of Engineers under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. Information relative to the Corps' of Engineers permits may be obtained from:

U.S. Army Corps of Engineers
Detroit District Office
P.O. Box 1027
Detroit, Michigan 48231-1027
(313) 226-2218

You should not construe this letter to be a building permit, approval of the proposed project, or a waiver of the provisions of local building or zoning ordinances.

Thank you for this opportunity to be of assistance; your interest in providing safe flood plain development is appreciated. **If you have any questions regarding this letter, please contact Ms. Beth Tallon, Environmental Scientist in our Technical Services Section, at (317) 232-4160 or toll free at or 1-877-928-3755.**

Sincerely,

Andrea Gromeaux

Andrea Gromeaux
Technical Services Section Head
Division of Water

ASG/BLT

pc: Kankakee River Basin Commission
Cedar Lake Plan Commission
Lake County Plan Commission
Detroit District, Corps of Engineers

Office of the Lake County Surveyor

Lake County Government Center • 2293 North Main Street • Crown Point, Indiana 46307
Phone: (219) 755-3745 • Fax: (219) 755-3750

GEORGE VAN TIL
County Surveyor

July 31, 1998

Lawrence J. McClelland, Drainage and Surveying Administrator
Lake County Surveyor's Office
2293 North Main Street
Crown Point, IN 46307

Dear Larry,

Harza Environment Services, Inc. of Chicago, Illinois has requested information if Sleepy Hollow Ditch is a regulated drain under the Lake County Drainage Board's jurisdiction. I have researched our legal drain and Circuit Court files. After completing the research, I am unable to verify that the Sleepy Hollow Ditch located in Cedar Lake is a regulated drain, therefore it is not under the Lake County Drainage Board's jurisdiction.

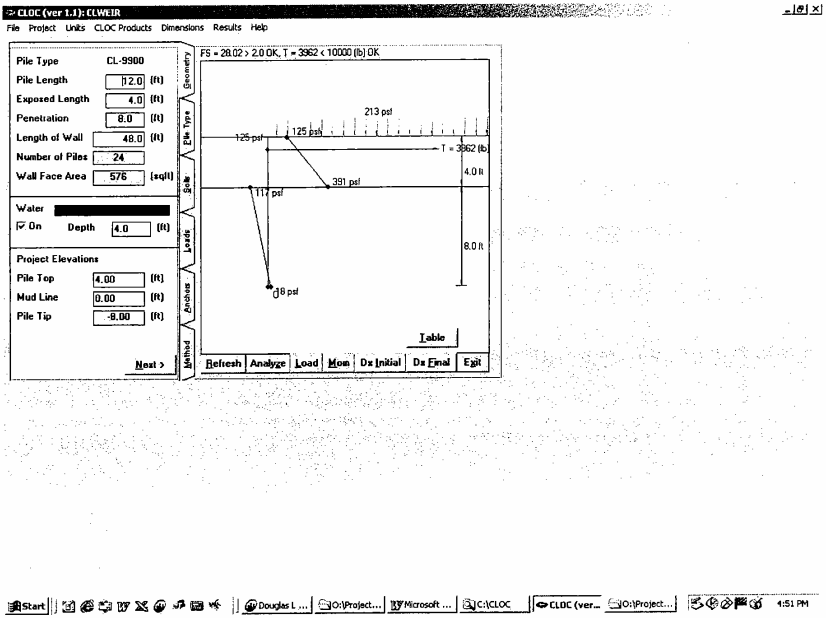
Very truly yours,

Joseph Fistrovich

Joseph Fistrovich

JPF/ar

APPENDIX F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Exposed Length 4.0 (ft)
Penetration 8.0 (ft)
Length of Wall 48.0 (ft)
Number of Piles 24
Wall Face Area 576 (sqft)
Water
On Depth 4.0 (ft)
Project Elevations
Pile Top 4.00 (ft)
Mud Line 0.00 (ft)
Pile Tip -8.00 (ft)
Next >
Geometry
Pile Type
Soils
Loads
Analyses
Method
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213 psf
125 psf
125 psf
T = 3962 (lb)
391 psf
117 psf
4.0 ft
8.0 ft
8 psf
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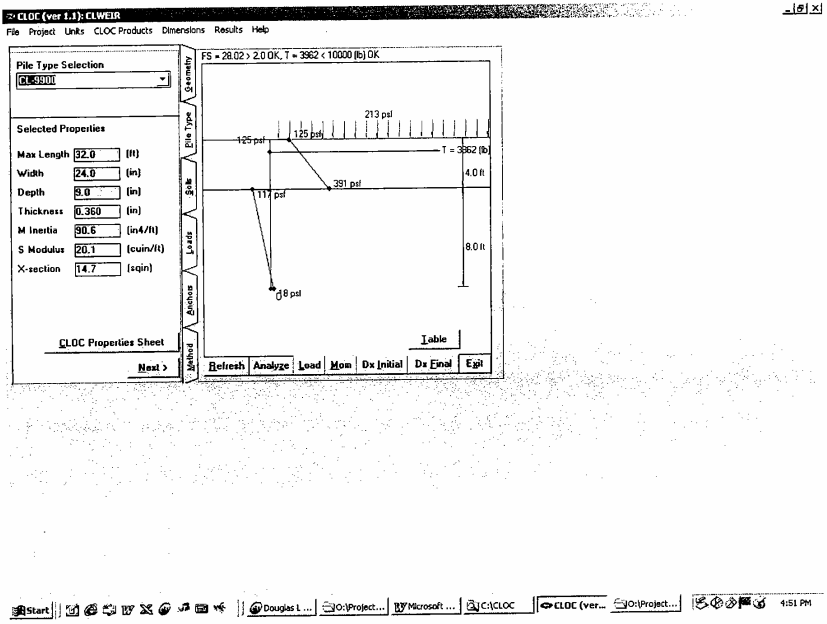
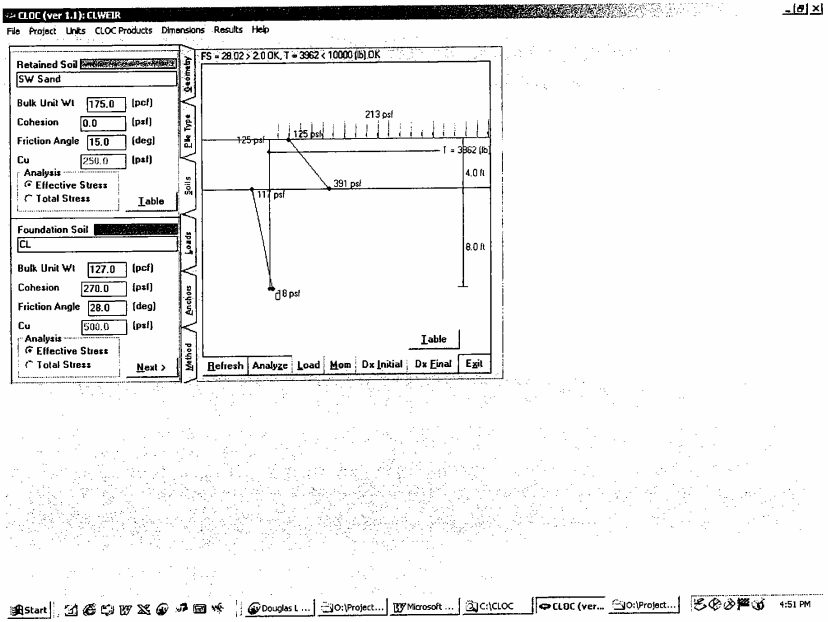
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
4:51 PM


CLOC (ver 1.1): CLWEIR
File Project Units CLOC Products Dimensions Results Help
Pile Type Selection
CL-3910I
Selected Properties
Max Length 32.0 (ft)
Width 24.0 (in)
Depth 9.0 (in)
Thickness 0.360 (in)
M Inertia 90.6 (in4/ft)
S Modulus 20.1 (cuin/ft)
X-section 14.7 (sqin)
CLOC Properties Sheet
Next >
Geometry
Pile Type
Soils
Loads
Anchors
Method
FS = 28.02 > 2.0 OK, T = 3962 < 10000 (lb) OK
213 psf
125 psf
125 psf
T = 3962 (lb)
4.0 ft
391 psf
117 psf
8.0 ft
8 psf
Table
Refresh
Analyze
Load
Mom
Dx Initial
Dx Final
Expl
Start
Douglas L ...
O:\Project...
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
4:51 PM


CLOC (ver 1.1): CLWEIR
File Project Units CLOC Products Dimensions Results Help
Retained Soil
SW Sand
Bulk Unit Wt 175.0 (pcf)
Cohesion 0.0 (psf)
Friction Angle 15.0 (deg)
Cu 250.0 (psf)
Analysis
Effective Stress
Total Stress
Table
Foundation Soil
CL
Bulk Unit Wt 127.0 (pcf)
Cohesion 270.0 (psf)
Friction Angle 28.0 (deg)
Cu 500.0 (psf)
Analysis
Effective Stress
Total Stress
Next >
Geometry
Elem Types
Soils
Loads
Anchors
Methods
FS = 28.02 > 2.0 OK, T = 3962 < 10000 (lb) OK
213 psf
125 psf
125 psf
T = 3962 lb
4.0 ft
391 psf
117 psf
8.0 ft
68 psf
Table
Refresh
Analyze
Load
Mom
Dx Initial
Dx Final
Exit
Start
Douglas L ...
O:\Project...
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
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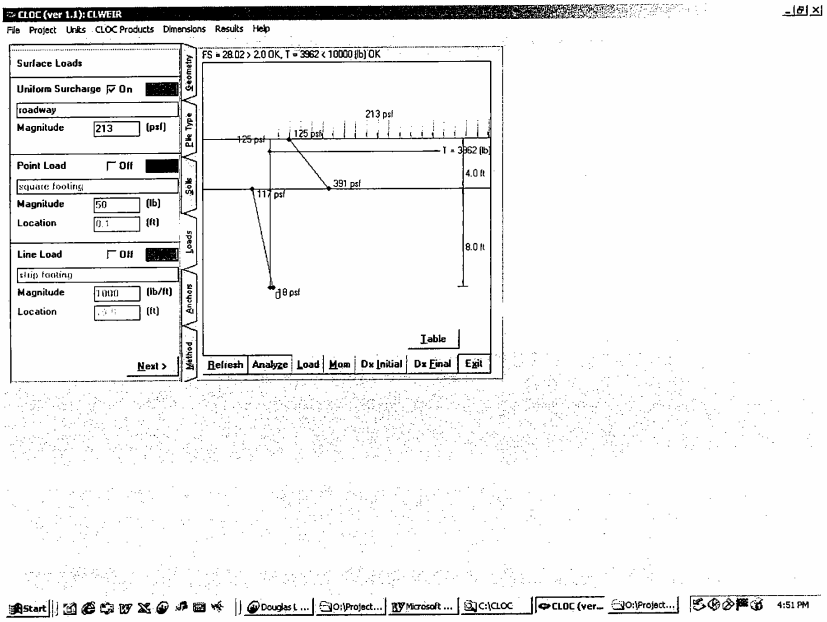
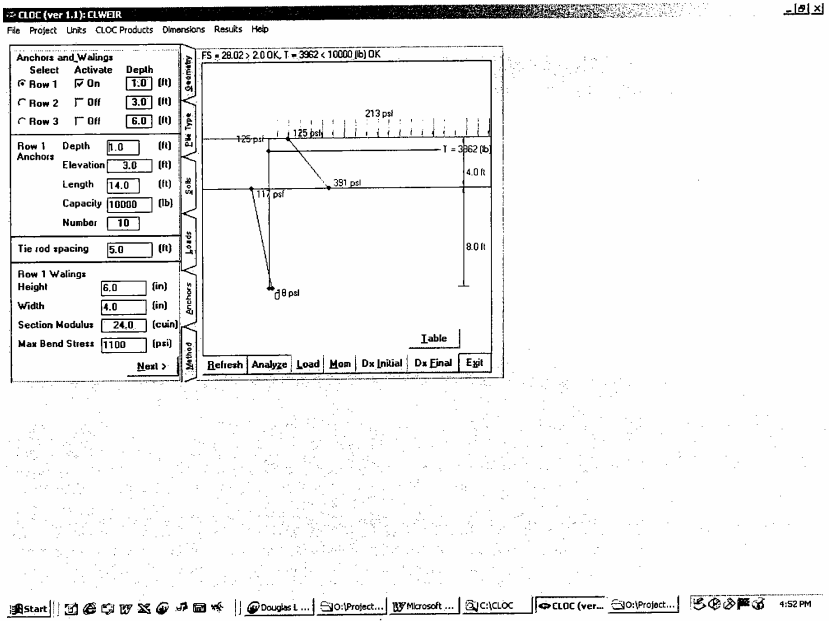
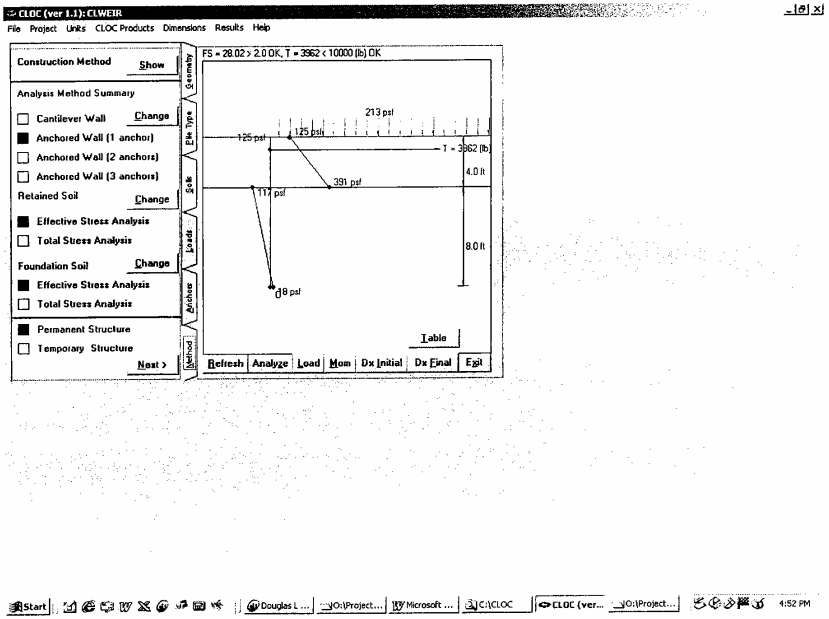
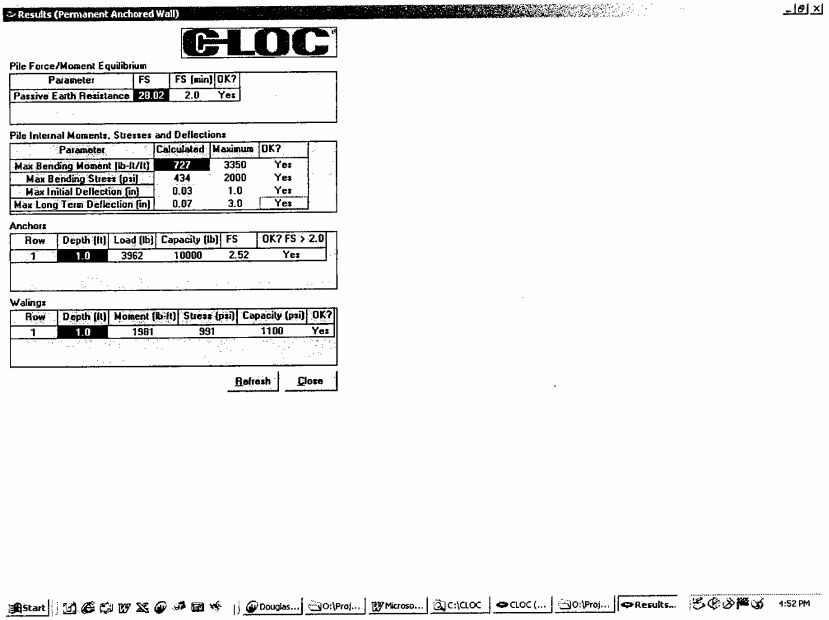

CLOC (ver 1.1): CLWEIR
File Project Units CLOC Products Dimensions Results Help
Surface Loads
Uniform Surcharge On
roadway
Magnitude 213 (psf)
Point Load Off
square footing
Magnitude 50 (lb)
Location 0.1 (ft)
Line Load Off
strip footing
Magnitude 1000 (lb/ft)
Location (ft)
Next >
Geometry
Pile Type
Soils
Loads
Anchors
Method
FS = 28.02 > 2.0 OK, T = 3962 < 10000 (lb) OK
213 psf
125 psf
125 psf
T = 3962 (lb)
4.0 ft
391 psf
117 psf
8.0 ft
8 psf
Table
Refresh
Analyze
Load
Mom
Dx Initial
Dx Final
Exit
Start
Douglas L ...
O:\Project...
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
4:51 PM


CLOC (ver 1.1): CLWEIR
File Project Units CLOC Products Dimensions Results Help
Anchors and Walings
Select Activate Depth
Row 1 On 1.0 (ft)
Row 2 Off 3.0 (ft)
Row 3 Off 6.0 (ft)
Row 1 Anchors
Depth 1.0 (ft)
Elevation 3.0 (ft)
Length 14.0 (ft)
Capacity 10000 (lb)
Number 10
Tie rod spacing 5.0 (ft)
Row 1 Walings
Height 6.0 (in)
Width 4.0 (in)
Section Modulus 24.0 (cuin)
Max Bend Stress 1100 (psi)
Next >
Geometry
Soil Type
Soils
Loads
Anchors
Methods
FS = 28.02 > 2.0 OK, T = 3962 < 10000 (lb) OK
213 psf
125 psf
125 psf
T = 3962 (lb)
4.0 ft
391 psf
117 psf
8.0 ft
0 psf
Table
Refresh
Analyze
Load
Mom
Dx Initial
Dx Final
Exit
Start
Douglas L ...
O:\Project...
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
4:52 PM


CLOC (ver 1.1): CLWEIR
File Project Units CLOC Products Dimensions Results Help
Construction Method
Show
Analysis Method Summary
Cantilever Wall
Change
Anchored Wall (1 anchor)
Anchored Wall (2 anchors)
Anchored Wall (3 anchors)
Retained Soil
Change
Effective Stress Analysis
Total Stress Analysis
Foundation Soil
Change
Effective Stress Analysis
Total Stress Analysis
Permanent Structure
Temporary Structure
Next >
Geometry
Pile Type
Soils
Loads
Anchors
Method
FS = 28.02 > 2.0 OK, T = 3962 < 10000 (lb) OK
213 psf
125 psf
125 psf
T = 3962 (lb)
4.0 ft
391 psf
117 psf
8.0 ft
0 psf
Table
Refresh
Analyze
Load
Mom
Dx Initial
Dx Final
Exit

Start
Douglas L ...
O:\Project...
Microsoft ...
C:\CLOC
CLOC (ver...
O:\Project...
4:52 PM

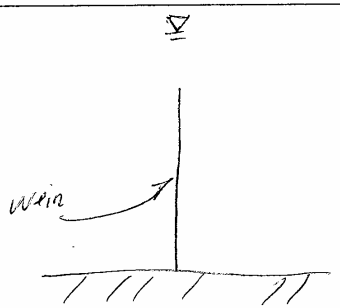

Results (Permanent Anchored Wall)
CLOC
Pile Force/Moment Equilibrium
Parameter | FS | FS (min) | OK?
Passive Earth Resistance | 28.02 | 2.0 | Yes
Pile Internal Moments, Stresses and Deflections
Parameter | Calculated | Maximum | OK?
Max Bending Moment (lb-ft/ft) | 727 | 3350 | Yes
Max Bending Stress (psi) | 434 | 2000 | Yes
Max Initial Deflection (in) | 0.03 | 1.0 | Yes
Max Long Term Deflection (in) | 0.07 | 3.0 | Yes
Anchors
Row | Depth (ft) | Load (lb) | Capacity (lb) | FS | OK? FS > 2.0
1 | 1.0 | 3962 | 10000 | 2.52 | Yes
Walings
Row | Depth (ft) | Moment (lb-ft) | Stress (psi) | Capacity (psi) | OK?
1 | 1.0 | 1981 | 991 | 1100 | Yes
Refresh
Close

Start
Douglas...
O:\Proj...
Microso...
C:\CLOC
CLOC (...
O:\Proj...
Results...
4:52 PM

MWH
MONTGOMERY WATSON HARZA

By D. Mulvey Date 6/17/02 Client Cedar Lake Sheet 1 of 1

Chkd. By Description Pressure on Sheetpile Weir Job No.



Max water velocity of 4.5 ft/s or 1.4 m/s determined for 100-yr flood from HEC-RAS modeling

$$P_{elevation\ 713} = (9.8 \times 10^3\ N/m^3)\left(\frac{2\ ft}{3.28\ \frac{ft}{m}}\right) = 5976\ N/m^2 = 5.98\ kPa$$

$$= 125\ lb/ft^2$$

$$P_{elevation\ 709} = (9.8 \times 10^3\ N/m^3)\left(\frac{6\ ft}{3.28\ \frac{ft}{m}}\right) + \frac{(1000\ kg/m^3)(1.4\ m/s)^2}{2}$$

$$= 18{,}620\ N/m^2 = 18.62\ kPa$$

$$= 390\ lb/ft^2$$

APPENDIX G

CEDAR LAKE SEDIMENT TRAP
INSPECTION AND MAINTENANCE
REPORT FORM

TO BE COMPLETED EVERY SUMMER

INSPECTOR: DATE:
PREVIOUS INSPECTION DATE:
CONCLUSIONS:

SEDIMENT BASIN

SEDIMENT ACCUMULATION					CONDITION OF BASIN SLOPES	CONDITION OF STORM WATER INFLOW CULVERT
INSPECTION POINTS		CONSISTENCY OF SEDIMENT	DEPTH TO FIRM SEDIMENT	ELEVATION OF FIRM SEDIMENT		
NO.	LOCATION					

OTHER OBSERVATIONS:

MAINTENANCE REQUIRED FOR SEDIMENT BASIN:

TO BE PERFORMED BY: ON OR BEFORE:

COMPLETED BY: DATE:

COMMENTS:

CEDAR LAKE SEDIMENT TRAP
INSPECTION AND MAINTENANCE
REPORT FORM

TO BE COMPLETED EVERY SUMMER

INSPECTOR: DATE:
PREVIOUS INSPECTION DATE:
CONCLUSIONS:

WETLAND VEGETATION

CONDITION OF VEGETATION		
SEDIMENT BASIN SHORELINE	LOW HEAD WEIR CREST	OUTSIDE LOW HEAD WEIR

OTHER OBSERVATIONS:

MAINTENANCE REQUIRED FOR WETLAND VEGETATION:

TO BE PERFORMED BY: ON OR BEFORE:

COMPLETED BY: DATE:

COMMENTS:

CEDAR LAKE SEDIMENT TRAP
INSPECTION AND MAINTENANCE
REPORT FORM

TO BE COMPLETED EVERY SUMMER

INSPECTOR: DATE:
PREVIOUS INSPECTION DATE:
CONCLUSIONS:

LOW HEAD WEIR

CONDITION OF CREST	CONDITION OF SIDE SLOPES	EVIDENCE OF SLOUGHING?

OTHER OBSERVATIONS:

MAINTENANCE REQUIRED FOR LOW HEAD WEIR:

TO BE PERFORMED BY: ON OR BEFORE:

COMPLETED BY: DATE:

COMMENTS:

APPENDIX H

Estimated Construction Costs

Item	Estimated Quantity	Unit	Unit Price	Total Price
Mobilization	All	—	Lump Sum	$ 5,000
Clearing and Grubbing	0.10	Acres	$ 30,000 /ac	$ 3,000
Excavation	43	yd^3	$ 24 /yd^3	$ 1,032
Plastic Sheet Pile	576	ft^2	$ 25 /ft^2	$ 14,400
Rip Rap	43	yd^3	$ 34 /yd^3	$ 1462
Filter Fabric	65	yd^2	$ 7 /yd^2	$ 455
Surveying	All	—	Lump Sum	$ 1,000
Dewatering of Work Area	All	—	Lump Sum	$ 3,000
Landscaping and Restoration	All	—	Lump Sum	$ 3,000
Demobilization	All	—	Lump Sum	$ 3,000
Subtotal				$ 35,350
Construction Inspection/Administration		@ 10%		3,500
Contingency		@ 15%		5,300
Total				$ 45,000

Cost Estimate Quantities Back-up

Sheetpile $(48\,ft)(12\,ft) = 576\,ft^2$

Rip-Rap $\dfrac{(20\,ft)(10\,ft)(2\,ft) + (10\,ft)(38\,ft)(2\,ft)}{27\,ft^3/yd^3} = 43\,yd^3$

Excation → Volume removed for rip-rap $= 43\,yd^3$

Filter fabric $\dfrac{(10ft)(58\,ft)}{9\,ft^2/yd^2} = 65\,yd^2$

Clearing + Grubbing

$\dfrac{(50\,ft)(80\,ft)}{43{,}560\,ft^2/ac} = 0.10$ acres